FINAL

July 6, 2007

SAMPLING AND ANALYSIS PLAN FOR ACTIVITY-BASED INDOOR AIR EXPOSURES OPERABLE UNIT 4 LIBBY, MONTANA, SUPERFUND SITE

Prepared by:
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Region 8
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CDM

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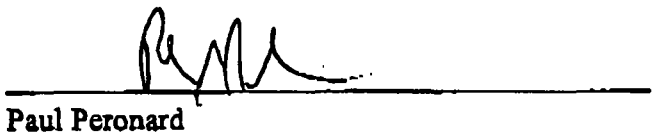
APPROVAL PAGE

This Activity-Based Outdoor Air Sampling Plan for Operable Unit 4 of the Libby, Montana, Superfund Site has been prepared by the U.S. Environmental Protection Agency, Region 8, with technical support from Syracuse Research Corporation and CDM, Inc. Study activities addressed in this Plan are approved.



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7/9/07
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DOCUMENT REVISION LOG

Revision	Date	Primary Changes
0	07/06/2007	--

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ABS	Activity-Based Sampling
CAR	Corrective Action Request
CDM	CDM Federal Programs Corporation
CIC	Community Involvement Coordinator
CSS	Contaminate Screening Study
COC	Chain-of-Custody
DQOs	Data Quality Objectives
EDD	Electronic Data Deliverable
EPA	Environmental Protection Agency
f/cc	Fiber per Cubic Centimeter
FSDS	Field Sample Data Sheet
FSP	Field Sampling Plan
Ft^2	square feet
GO	Grid Opening
GSD	Geometric Standard Deviation
GPS	Global Positioning System
hrs/day	Hours Per Day
hrs	Hours
HASP	Health and Safety Plan
HQ	Hazard Quotient
IABS	Interior Activity-Based Sampling
IDW	Investigation Derived Waste
ISO	International Organization for Standardization
Kg	Kilogram
L	Liters
L/min	Liters Per Minute
LA	Libby Amphibole asbestos
MCE	Mixed-Cellulose Ester
MET	Meteorological
min/hr	Minutes per hour
mm	Millimeter
mm^2	Square Millimeter
mph	Miles Per Hour
ND	Non-Detect
NOAA	National Oceanic Atmospheric Administration
NSUA	Non-Specific Use Area
NVLAP	National Voluntary Laboratory Accreditation Program

OU	Operable Unit
PCM	Phase Contrast Microscopy
PCME	Phase Contrast Microscopy Equivalent
PDI	Pre-Design Inspection
PLM	Polarized Light Microscopy
PLM-VE	Polarized Light Microscopy – Visual Estimation
PLN	Poisson Lognormal
PM	Project Manger
PPE	Personal Protective Equipment
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RBF	Risk-Based Fraction
RfC	Reference Concentration
s/cc	Structures Per Cubic Centimeter
s/cm^2	Structures Per Square Centimeter
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
Stved	Standard Deviation
SRC	Syracuse Research Corporation
SUA	Specific Use Area
SWQAPP	Site-Wide Quality Assurance Project Plan
TEM	Transmission Electron Microscopy
TL	Team Leader
TWF	Time Weighting Factor
UCL	Upper Confidence Limit
ug/m^3	micrograms per cubic meter
um	micrometer
UR	Unit Risk
VCS	Vermiculite Containing Soil
VI	Vermiculite Insulation
yrs	years
°F	Degrees Fahrenheit
$\geq$	Greater Than or Equal To
$\leq$	Less Than or Equal To
>	Greater Than
<	Less Than
%	Percent

SAMPLING AND ANALYSIS PLAN FOR ACTIVITY-BASED INDOOR AIR EXPOSURES OPERABLE UNIT 4 LIBBY, MONTANA, SUPERFUND SITE

1.0 INTRODUCTION

This document is the sampling and analysis plan (SAP) for the collection and analysis of samples of indoor air and potential sources of indoor air contamination at residential and commercial buildings located within Operable Unit (OU) 4 of the Libby, Montana, Superfund Site. OU4 includes most current homes and businesses in the community of Libby.

This SAP contains the elements required for both a field sampling plan (FSP) and quality assurance project plan (QAPP). This SAP has been developed in accordance with the Environmental Protection Agency (EPA) Requirements for Quality Assurance Project Plans (EPA 2001), the Guidance on Systematic Planning Using the Data Quality Objectives Process – EPA QA/G4 (EPA 2006), and the Site-Wide QAPP (SWQAPP) (CDM 2007a). The SAP is organized as follows:

Section 1 – Introduction
Section 2 – Background and Problem Definition
Section 3 – Data Quality Objectives (DQOs)
Section 4 – Sampling Program
Section 5 – Laboratory Analysis and Requirements
Section 6 – Assessment and Oversight
Section 7 – Data Validation and Usability
Section 8 – Project Schedule
Section 9 – References

2.0 BACKGROUND AND PROBLEM DEFINITION

Libby is a community in northwestern Montana that is located near a large open-pit vermiculite mine. Vermiculite from this mine contains varying levels of a form of asbestos referred to as Libby Amphibole asbestos (LA). Historic mining, milling, and processing operations at the site are known to have caused releases of vermiculite and LA to the environment that have caused a range of adverse health effects in exposed people, including not only workers at the mine and processing facilities (Amandus and Wheeler 1987, McDonald et al. 1986, McDonald et al. 2004), but also in residents of Libby (Peipins et al. 2003).

Starting in 2000, EPA began taking a range of cleanup actions at the site to reduce or eliminate sources of LA exposure to residents and workers. In the early stages, efforts were focused mainly on wastes remaining at former vermiculite processing areas (the screening plant, export plant, etc.). As work progressed, attention soon shifted to cleanup of current homes and workplaces in OU4. The protocol that EPA developed for investigating sources of LA at specific properties and deciding when to take action is detailed in a Technical Memorandum issued in December 2003 (EPA 2003). Cleanup actions taken under this protocol typically include removal of unenclosed vermiculite insulation (VI) from living spaces and other readily accessible spaces (e.g., unfinished attics), removal of some or all contaminated outdoor soils, and may, in some cases, include cleanup of indoor dusts.

2.1 Problem Definition

One issue of high priority to EPA is an evaluation of the efficacy and protectiveness of the current cleanup strategy. That is, answers are needed for the following questions:

- At a property that EPA has investigated and found no reason to take any cleanup actions under the approach described in EPA (2003), are the risks that remain sufficiently small to be considered acceptable?
- At a property where EPA has investigated and determined that one or more sources was present that required cleanup under the approach described in EPA (2003), are the risks that remain after the cleanup is complete sufficiently small to be considered acceptable?

Note: For convenience, in this document, the phrase "**post-cleanup property**" will be used to indicate any property where EPA has investigated sources and has either taken cleanup action or else determined that no cleanup action is needed under the current decision-making protocol.

Residual exposures that may remain at post-cleanup properties may be divided into two main types:

- Exposures that occur inside the building
- Exposures that occur outside the building

This SAP is focused on collection of data needed to support an evaluation of the residual level of exposure and risk that may exist inside post-cleanup properties. Collection of data needed to evaluate residual exposures and risks from exposures that occur outside the building at post-cleanup properties is addressed in a separate sampling plan (EPA 2007).

2.2 Conceptual Model for Post-Cleanup Indoor Exposures

Cleanup actions at a property are intended to address both indoor or outdoor sources that exceed the trigger levels specified in the Technical Memorandum (EPA 2003). However, the cleanup strategy may leave some residual sources and exposure pathways in place. The residual sources that may impact indoor air at post-cleanup properties are discussed below.

2.2.1 Outdoor Air

All buildings exchange indoor air for outdoor air (ventilation). In warm weather, this may occur through open windows or doors. In cold weather, heating of indoor air creates a negative pressure inside the building, and this tends to draw outdoor air in through leaks and cracks in the building. Thus, in the absence of other sources, levels of LA in indoor air in a post-cleanup building are expected to be generally similar to the levels in outdoor ambient air in that area.

2.2.2 Releases from Residual Indoor Sources

As noted above, if a building is found to contain unenclosed VI in an accessible area that unenclosed VI is removed as part of the EPA cleanup action. Moreover, if any observable leakage of VI into indoor living space is observed, this area is also cleaned up. Finally, if indoor dust is found to contain more than 5,000 LA structures per square centimeter (s/cm^2), the indoor dust is also cleaned up. Thus, under post-cleanup conditions, the residual indoor sources of LA contamination in indoor dust and indoor air may include: 1) trace levels of VI or LA from areas that have been cleaned, 2) residual VI or LA in areas that have not been cleaned, including floor, carpets, upholstery, air ducts, etc., and 3) VI that is presently contained in an intact structure (e.g., a wall).

2.2.3 Transport from Contaminated Areas of Yard Soil

Under the current cleanup protocol (EPA 2003), outdoor soils are divided into "specific use areas" (SUAs) that include areas such as gardens and play areas where human exposure is likely to occur on a frequent basis, and "non-specific use areas" (NSUAs) that include general areas of the yard where human exposure is likely to occur less frequently. Under the current approach (EPA 2003), the triggers for cleanup (removal and replacement with clean fill) of outdoor soil are summarized below:

Mandatory Triggers (these conditions always trigger a soil clean-up in the location exceeding the trigger)

- Any level of visible vermiculite in a SUA
- Gross levels of visible vermiculite (approximately 50 percent (%) by volume or higher) in a NSUA
- Any location where analysis by polarized light microscopy-visual area estimation (PLM-VE) is equal to or greater than 1%

Conditional Trigger (this condition does not trigger a clean-up of the area unless some other trigger for cleanup has been exceeded at the property)

- Any area where PLM-VE is greater than (>) non-detect (ND) but less than (<) 1% (ND = not detected)

Thus, the types and levels of LA and vermiculite that may remain in outdoor soil at a post-cleanup property are summarized below:

Case	Potential Residual Sources in Outdoor Soil
1. No cleanup triggers were exceeded either indoors or outdoors; no action taken	- non-gross visible vermiculite in any NSUA - PLM-VE < 1% in any area
2. One or more triggers were exceeded (either indoors and/or outdoors); cleanup action taken	- non-gross visible vermiculite in a NSUA (PLM-VE = ND)

Notes: NSUA – non-specific use area; PLM-VE - polarized light microscopy-visual area estimation; < - less than; % - percent; ND – non-detect

These residual sources in outdoor soil may serve as a continuing source of LA into indoor spaces by transport of contaminated soil on shoes, clothing, etc.

2.2.4 Transport from Other Sources

In the past, transport of LA into homes may have occurred on the clothing of workers at the mine or processing areas. Likewise, transport may have occurred from readily accessible piles of waste vermiculite that were present at various locations around the community. Although the mine has ceased operation and EPA has removed contamination from a number of the most heavily contaminated publicly accessible source areas, some smaller or less contaminated source areas may still remain, and these could serve as a continuing source for contamination of indoor dust and indoor air.

2.3 Overview of Existing Data

EPA has collected some initial data on the levels of LA that occur in indoor air at pre- and post-cleanup properties (EPA 2005). The available data[1] for pre-cleanup properties are shown in Figure 2-1. In brief, personal air samples were collected from people who were engaged in either "routine" indoor activities, or who were engaged in "active cleaning" (dusting and sweeping). Stationary air samples and indoor dust samples were also collected at each sampling location. As seen in Figure 2-1, a wide range of LA levels were observed in both personal and stationary indoor air, with little apparent dependence on the measured level of LA in dust collected from indoor surfaces. This result is somewhat unexpected, because it is generally assumed that LA in indoor dust is likely to be a significant source of LA in indoor air.

The available indoor air data[1] from four post-cleanup properties are summarized in Figure 2-2. In brief, indoor air stationary monitors were used to collect indoor air samples at varying time periods following completion of all cleanup actions at the property. As seen, levels were generally low following cleanup, and remained low for about a year. However, at some of the homes, there appears to be an upward trend, suggesting the potential for re-contamination. EPA is presently evaluating these data and selecting follow-up activities to further clarify the reason for the apparent increases.

While informative, these initial data are not sufficient to support reliable risk assessment or risk management decisions regarding exposure or risks from indoor air because of the following data limitations:

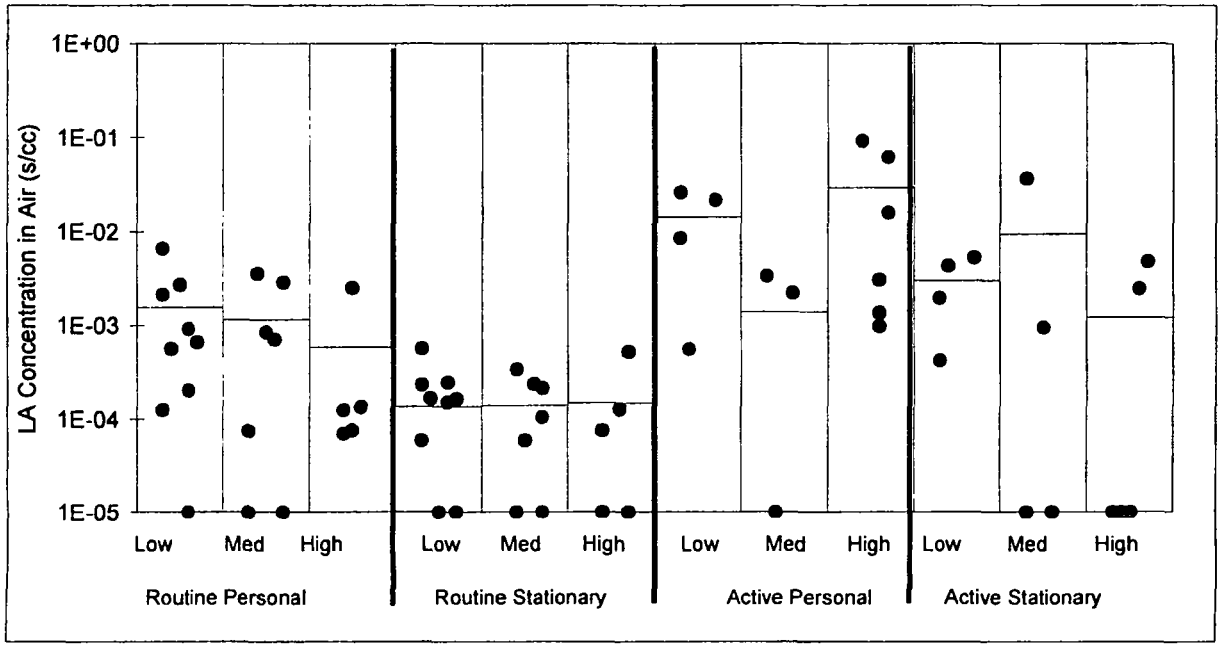
- Not enough samples have been collected to adequately limit statistical uncertainty
- Not enough samples have been collected to ensure adequate spatial and temporal (seasonal) representativeness of the data

[1] Note: the data shown in Figures 2-1 and 2-2 are not yet fully validated and some values may be revised as needed.

- Not enough data have been collected to establish a quantitative relation between LA levels in indoor dust and LA levels in indoor air.

Thus, the primary problem that this SAP seeks to address is the lack of sufficient data on indoor air levels to support decisions about residual exposure and risks from LA in indoor air at post-cleanup properties in Libby.

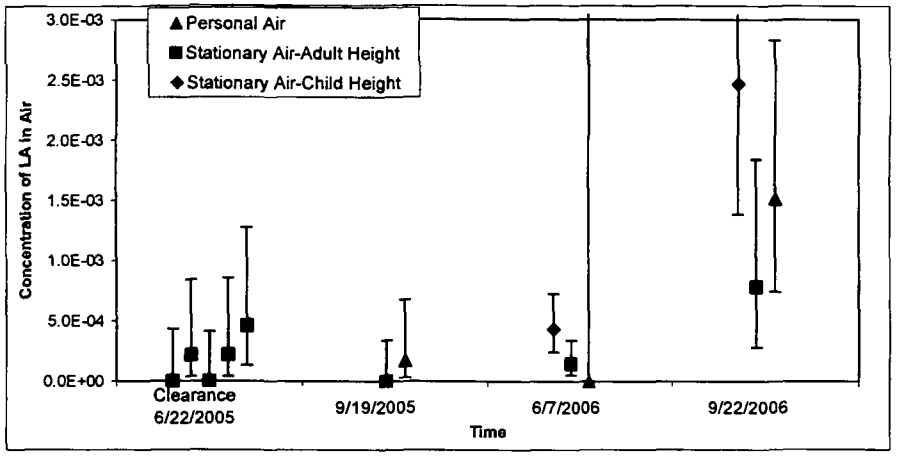
FIGURE 2-1
AVAILABLE DATA ON INDOOR AIR LEVELS AT PRE-REMEDIATION HOMES IN LIBBY



Dust Rank	Statistic	Dust (s/cm^2)	Rountine Air (s/cc)		Active Air (s/cc)	
			Personal	Stationary	Personal	Stationary
All	N	32	21	24	14	14
	Mean	427	1.19E-03	1.40E-04	1.70E-02	4.06E-03
	Stdev	1479	1.68E-03	1.59E-04	2.75E-02	9.55E-03
	UCL	1567	2.36E-03	4.62E-04	5.21E-02	2.29E-02
Low	N	15	9	12	4	4
	Mean	3	1.55E-03	1.37E-04	1.42E-02	2.99E-03
	Stdev	6	2.12E-03	1.64E-04	1.18E-02	2.20E-03
	UCL	9	4.42E-03	5.67E-04	2.60E-02	5.26E-03
Med	N	10	7	7	4	4
	Mean	64	1.16E-03	1.40E-04	1.40E-03	9.38E-03
	Stdev	39	1.47E-03	1.27E-04	1.67E-03	1.81E-02
	UCL	86	3.58E-03	2.33E-04	3.36E-03	3.66E-02
High	N	7	5	5	6	6
	Mean	1855	5.84E-04	1.50E-04	2.92E-02	1.22E-03
	Stdev	2872	1.08E-03	2.15E-04	3.87E-02	2.02E-03
	UCL	5310	2.51E-03	4.81E-03	6.11E-02	4.81E-03

Note: Some data have not yet been fully validated and some data points may be revised in the future.
s/cc – structure per cubic centimeter; s/cm2 – structures per square centimeter; N – number of samples; UCL – upper confidence limit; Stdev – standard deviation

FIGURE 2-2
INDOOR AIR RESULTS FOR POST CLEANUP PROPERTIES



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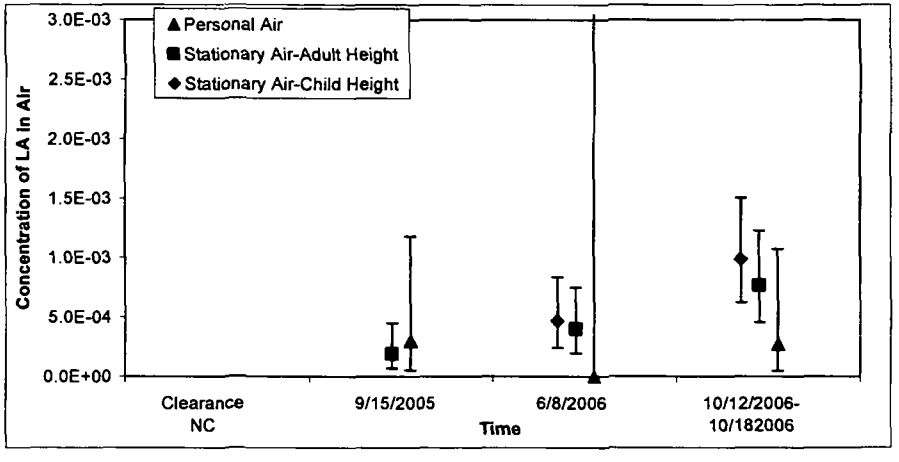
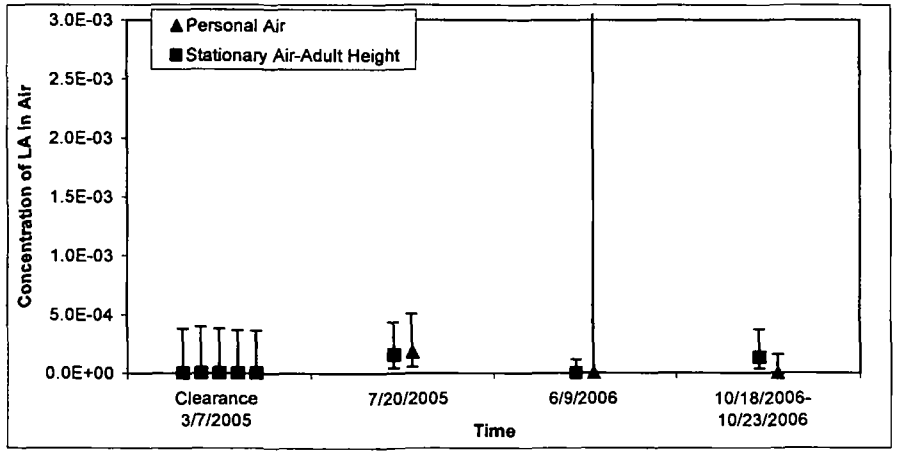
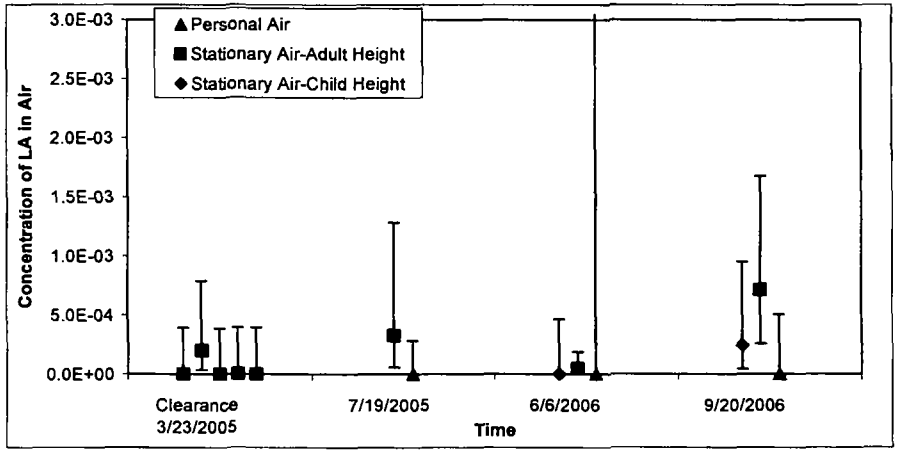


709 E. 5th St.





3.0 DATA QUALITY OBJECTIVES

DQOs are statements that define the type, quality, quantity, purpose, and use of data to be collected. The design of a study is closely tied to the DQOs, which serve as the basis for important decisions regarding key design features such as the number and location of samples to be collected and the chemical analyses to be performed. In brief, the DQO process typically follows a seven-step procedure, as follows:

1. State the problem that the study is designed to address
2. Identify the decisions to be made with the data obtained
3. Identify the types of data inputs needed to make the decision
4. Define the bounds (in space and time) of the study
5. Define the decision rule which will be used to make decisions
6. Define the acceptable limits on decision errors
7. Optimize the design using information identified in Steps 1-6

Following these seven steps helps ensure that the project plan is carefully thought out and that the data collected will provide sufficient information to support the key decisions which must be made. The following paragraphs implement the DQO process for this project.

3.1 State the Problem

EPA has been working to clean up both indoor and outdoor sources of VI, vermiculite-containing soil (VCS) and LA at properties in OU4. However, under the current cleanup strategy (EPA 2003), some residual level of LA may remain at post-cleanup properties, both indoors and outdoors. Therefore, in order to determine if the current cleanup strategy is both effective and protective, the primary goal of this effort is as follows:

> *Primary Objective (Evaluate Efficacy and Protectiveness)*
>
> Collect data needed to characterize the level of residual exposure and risk from indoor exposures that may remain at post-cleanup properties. If some properties have residual risk above a level of concern, identify the most likely residual source(s) contributing to the contamination so that the cleanup strategy may be revised to increase protectiveness.

While evaluation of risks from indoor air at any specific post-cleanup property may be assessed by direct assessment of indoor air samples from that property, it is desirable, if possible, to develop a method for predicting the level of risk from indoor air based on measurements of the level and extent of known residual sources. If such a method can be developed and shown to yield reliable predictions, then this method may be used to compute risk-based concentrations

(RBCs) of LA in various source materials, and this information can be used to help guide cleanup actions at the site. Based on this, the secondary objective of this effort is:

Secondary Objective (Develop Exposure Model)

Collect sufficient data on the level of LA in indoor air and in potential source media (e.g., indoor dust, outdoor soil, ambient air) that a quantitative model may be developed to predict indoor air levels from data on source levels with sufficient accuracy to support cleanup and risk management decisions.

3.2 Identify the Decisions

The data to be collected during this effort are intended to support the following decisions:

1) Are current strategies for cleaning up properties in OU4 adequate to provide health protection from exposures in indoor air?

> Note: In making this decision, it is important to emphasize that the basis for assessing the level of cancer risk from asbestos is currently undergoing Agency review, and the approach may be revised in the future as new methods are developed and as new toxicity data on asbestos are obtained. In addition, EPA has not yet developed a method for assessing non-cancer risks from inhalation exposure to asbestos. Thus, all evaluations of protectiveness that are based on currently available risk assessment methods should be viewed as interim, and these interim decisions may be revised in the future as methods and data for assessing the cancer and non-cancer risks of asbestos are improved.

2) If indoor air levels are above a level of concern in some post-cleanup buildings, what are the residual indoor or outdoor sources most likely to be responsible?

3) Do the data indicate a quantifiable relationship between the level and extent of LA in residual sources and the level observed in indoor air? If so, can long-term average exposure levels be predicted with sufficient accuracy to be useful in risk assessment and risk management decision-making?

3.3 Identify the Types of Data Needed

The data needed to achieve the primary objective of this effort consist of measures of LA in indoor air at a wide variety of post-cleanup properties. In order to achieve the secondary

objective, data are also required on the types and levels of residual sources that may remain at each location. The following sections identify key attributes of the data needed for this effort.

3.3.1 Sampling Locations

Based on the current protocol for cleanup actions at a property, post-cleanup locations may be stratified into the following categories based on whether or not outdoor soil cleanup actions were taken, and on what remains in outdoor soil post-cleanup:

Category	Did Outdoor Soil Cleanup Take Place?	Post-cleanup Surface Soil		
		VCS		PLM Detect
1	No	-	and	-
2		+	or	+
3	Yes	-	and	-
4		+	and	-

Notes: VCS - vermiculite-containing soil; PLM - polarized light microscopy

In order to ensure that the set of post-cleanup properties selected for assessment in this effort are representative, the data set collected during this effort should include a number of properties from each category. This stratification will also help increase the ability to identify potential residual sources of concern if post-cleanup levels are found to exceed a level of health concern.

Note that, as part of the data collection effort for this project, additional data (both visual and analytical) will be collected to better characterize the level and extent residual LA contamination in outdoor soil at post-cleanup properties (see Section 3.3.3, below). These additional data will be used in the analysis of the data to search for relationships between indoor air and outdoor soil, and may, if available in a timely fashion, help guide the selection of properties for testing to ensure a representative set of properties are evaluated.

3.3.2 Types of Indoor Air Samples

There are a variety of different options for collecting samples of indoor air. Important variables include:

- Type of sampling device (personal *vs.* stationary monitor)
- Type of activity occurring during sampling

Indoor air samples may also be collected under a variety of differing activity scenarios, with varying levels of activity and source disturbance. While there are a wide variety of such activities, it is not necessary to collect data under every possible combination of activity and source disturbance. Rather, for the purposes of this effort, samples should be representative of two generic conditions:

- Active behaviors
  This category includes a wide range of indoor activities in which a person is moving about the building and potentially disturbing indoor sources. For example, walking from room to room, sitting down on upholstered chairs, dusting, sweeping, vacuuming, and moving furniture would all be included.
- Passive behaviors
  This category includes activities such as sitting and reading a book, watching television, and working at a desk. The key attribute is that the person is engaging in minimally energetic actions that will have low tendency to disturb source materials.

Section 4.2 provides a more detailed description of the specific activities that will be included in each activity category during sample collection.

3.3.3 Data on Residual Source Levels

As noted above, the secondary objective of this effort is to obtain data on the relationship between LA levels in indoor air and in various potential residual sources, including ambient air, outdoor soil, and indoor dust.

Outdoor Ambient Air

Data on LA levels in ambient air are presently being collected on an on-going basis at 14 stations in OU4. Thus, no additional ambient air sampling is needed. The data from the ambient air program will be utilized to help evaluate the contribution of outdoor air to indoor air.

Outdoor Soil Samples

Data on LA levels in pre-cleanup outdoor soil are available as part of the Contaminant Screening Study (CSS) and (in some cases) the Pre-Design Inspection (PDI) performed at each cleanup property. While the post-cleanup pattern of residual VCS and LA in yard soil can be deduced from the property specific CSS, PDI, and removal design, a substantial level of effort is needed to estimate area-weighted average post-cleanup soil levels from this report. Therefore, supplemental data on the level and extent of residual soil contamination will be collected at all properties evaluated as part of this effort. This supplemental data will consist of four parts:

- Surficial soils will be inspected at a maximum density of 1 point per 100 square feet (ft^2) and a semi-quantitative estimation of vermiculite quantity will be assigned to each point inspection.
- A sketch of the yard that shows the location and size of any areas with visible vermiculite, along with an indication of the relative amount as described in the Site-Specific Standard Operating Procedure (SOP) CDM-SOP LIBBY-06, Revision 1
- One 30-point composite soil sample than combines soils from all NSUAs, to be analyzed by PLM-VE
- One 30-point composite sample that combines soils from all SUAs, to be analyzed by PLM-VE

These data will provide a sufficient characterization of residual outdoor soil levels at various categories of post-cleanup properties, and will support an assessment of whether residual VCS or LA in outdoor soil may pose a continuing source to indoor dust or air.

Indoor Dust

Data on pre-cleanup indoor dust levels are collected at each cleanup property as part of the CSS or PDI, but post-cleanup dust samples are generally not collected, even when an indoor dust cleanup occurs. Therefore, in order to support the secondary objective of this sampling effort, indoor dust samples will be collected at all post-cleanup properties selected for inclusion. Dust samples will be collected from floors and other horizontal surfaces that may be disturbed by routine indoor activities. Dust samples will be collected using a microvacuum technique, collecting one sample from each living floor at post-cleanup property, as described in Section 4.2.2.

Other Indoor Sources

As noted above, other residual sources that may contribute to LA in indoor air in post-cleanup properties includes things such as carpets, upholstery, air ducts, and VI in enclosed spaces. While there are too many independent variables to allow measurement and stratification of sampling locations based on all of these potential residual sources, it is important that the data collected at each property include a thorough documentation of all potential sources known to exist in the building. Information collected regarding residual sources will be captured on an Activity Based Sampling (ABS) Property Background and Sampling Form included in Appendix A. If a subset of properties is recognized as having higher indoor air levels of LA than most others, these data on residual sources may help form hypotheses about which residual sources are most likely to be responsible, which in turn may form the basis for a focused follow-up investigation, as may be judged necessary to support decision-making. If information collected

on the ABS investigation form is inconsistent with data collected during previous investigations, the current override system of updating property information in the project database (Libby2) will be used.

3.4 Define the Bounds of the Study

3.4.1 Spatial Bounds

The spatial bounds of this study are restricted to properties located within OU4 of the Libby Superfund site. This OU includes most current residential and commercial properties in the community. Note, however, that the results of this study may also be useful in assessing cleanup efficacy under similar conditions in other operable units at the site.

3.4.2 Temporal Bounds

Human health risk from exposure to LA in indoor air is related to the long-term average concentration in indoor air. Because the level of LA in indoor air may depend on factors that vary seasonally (e.g., indoor activity patterns, humidity, building ventilation rate), the data set needed for this effort should consist of multiple samples from each residence, spanning a range of time points and meteorological conditions. This will help ensure that reliable estimates of long-term average concentration may be computed from the individual short-term measurements.

3.5 Define the Decision Rule

3.5.1 Primary Decision Rule

For the primary objective of this effort (evaluation of cleanup efficacy), the decision rule is:

> If the level of risk to humans from exposure to indoor air at a post-cleanup location, when combined with the level of risk which applies to the same individuals from other applicable exposure pathways, does not exceed a cancer risk of 1E-04 or a non-cancer Hazard Quotient (HQ) of 1.0, then risks at that property will be considered acceptable. If the total risk exceeds a cancer risk of 1E-04 or an HQ of 1.0, then the feasibility of further reducing exposure from either the indoor air pathway and/or the other applicable exposure pathways shall be assessed.

At present, EPA has not developed a quantitative procedure for evaluating non-cancer risks, but has developed a method for quantification of cancer risk (IRIS 2007). The basic equation is:

$$Risk(i) = C(i) \cdot TWF(i) \cdot UR(i)$$

were:

Risk(i) = Risk of dying from a cancer that results as a consequence of exposure from specified exposure scenario "i"

C(i) = Average concentration of asbestos fibers in air as fibers per cubic centimeter (f/cc) during exposure scenario "i"

UR(i) = Unit Risk $(f/cc)^{-1}$ that is appropriate for exposure scenario "i"

TWF(i)= Time weighting factor for exposure scenario "i". This factor accounts for less-than-continuous exposure during the exposure interval.

Because each person can be exposed from more than one source, the total cancer risk is calculated by summing the risks from each exposure pathway that applies:

$$\text{Total risk} = \Sigma \text{ Risk(i)}$$

As noted above, this document is focused on collection of data on the concentration of asbestos that people breathe in indoor air in Libby. These data will be used to evaluate the risk from the indoor air exposure scenario. This risk estimate will, in turn, be combined with risk estimates for other pathways to estimate total exposure.

Because of limitations in the current methods for assessing risks from asbestos, all decisions regarding residual risk levels are considered interim, and interim decisions may be revisited in the future as new methods and new data become available.

3.5.2 Secondary Decision Rule

For the secondary objective of this effort (development of a quantitative indoor air exposure model based on measures of LA in residual sources), the decision rule is:

> If the available data establish a clear relationship between long-term average indoor air levels and levels of LA in one or more residual sources, it will be concluded that development of a quantitative exposure model is appropriate and this may be used to estimate exposure from indoor air at locations where no indoor air data have been collected. Conversely, if no apparent relationship between long-term indoor air levels and residual sources can be established, it will be concluded that predictive approaches are not feasible at this site, and that other strategies for evaluation of exposure from indoor air are needed.

3.6 Define the Acceptable Limits on Decision Errors

3.6.1 Primary Decision Rule

In making decisions about the long-term average concentration of LA in indoor air and the level of health risk associated with that exposure, two types of decision errors are possible:

- A false negative decision error would occur if a risk manager decides that exposure to indoor air is not of significant health concern, when in fact it is of concern.
- A false positive decision error would occur if a risk manager decides that exposure to indoor air is above a level of concern, when in fact it is not.

EPA is most concerned about guarding against the occurrence of false negative decision errors, since an error of this type may leave humans exposed to unacceptable levels of LA in indoor air. For this reason, it is anticipated that decisions regarding this pathway will be based not only on the best estimate of the long term average concentration, but will also consider the 95% upper confidence limit (UCL) of the long-term average concentration. Use of the UCL to estimate exposure and risk helps account for limitations in the data, and provides a margin of safety in the risk calculations, ensuring that risk estimates are unlikely to be too low.

EPA is also concerned with the probability of making false positive decision errors. Although this type of decision error does not result in unacceptable human exposure, it may result in unnecessary expenditure of resources. For the purposes of this effort, the strategy adopted for controlling false positive decision errors is to seek to ensure that, if the exposure estimate based on the 95% UCL is above EPA's level of concern for this pathway, then the UCL is not larger than 3-times the best estimate of the mean. If the 95% UCL is at or above the range that is of potential concern, and the UCL is greater than 3 times the best estimate of the mean, then it will be concluded that there is a substantial probability of a false positive error and that more data may be needed to strengthen decision-making.

3.6.2 Secondary Decision Rule

In determining whether the data are adequate to support development of a quantitative exposure model for indoor air, the key issue is how accurately the model can predict the observed long-term average indoor air concentration as a function of the data available on the concentration of asbestos in potential sources. The general form of the model would be as follows:

$$C(\text{Indoor air}) = k1 \cdot C(\text{Outdoor air}) + k2 \cdot C(\text{Indoor dust}) + k3 \cdot C(\text{Outdoor soil}) + k4 \cdot C(\text{Other sources})$$

where k1, k2, k3 and k4 are empiric "transfer factors" to be derived from the data that characterize the relative contributions of each source to indoor air.

Although final evaluations can not be made until a model is developed and assessed, if predicted concentration in indoor air are found to be within 2-fold of observed long-term average values at 80% or more of evaluated properties, the model will be considered to be appropriate for use in quantitative risk assessment and in supporting risk management decision making. If the predictive accuracy of the model does not achieve this level, then the model may be used semi-quantitatively, coupled with an appropriate identification and discussion of the attendant uncertainty in the calculations.

3.7 Optimize the Design

3.7.1 Limiting the Uncertainty in Estimates of Long-Term Average Concentration

The method used to compute the UCL of a set of indoor air samples depends on the statistical properties of the data set. At present, data on the distributional form and between-sample variability are limited. Figure 3-1 shows log-probability plots of available personal indoor air samples stratified by activity level (active *vs.* routine). As seen, the data are moderately well-characterized by a lognormal distribution, and the value of sigma appears to be in the range of about 2 (geometric standard deviation [GSD] = 7-8). Note that these data are not stratified by level of LA in source materials, so actual values of sigma may be somewhat lower.

If it is assumed that the variability between different samples is likely to be approximately lognormal, then the data set collected from a location or a set of similar locations may be approximated by a mixed Poisson lognormal (PLN) distribution. Statistical procedures are available to estimate the parameters of the underlying lognormal distribution (Haas et al. 1999), and these fitted parameters may be used to compute the UCL of the mean using the approach for lognormal data sets described in EPA 1992. Based on this approach, the ratio of the UCL to the mean of a data set (an indication of the statistical uncertainty in the data) is given by:

$$\frac{UCL}{Mean} = \exp\left(\sigma H / \sqrt{(n-1)}\right)$$

where:

σ = log standard deviation of the measured values
H = statistic described in EPA 1992
n = number of samples

Figure 3-2 illustrates the ratio of the UCL to the mean as a function of n for an assumed value of σ of 2.0. As seen, the ratio (a measure of uncertainty) approaches a value of about 2 as the number of samples approaches about 80-100, and continues to decline slowly as the number of samples increases. Based on this analysis, it is expected that if a total of about 80-100 samples per property type were collected, the uncertainty in the average concentration would be limited to less than a factor of 3, and that collection of additional samples would result in minimal decreases in uncertainty. Because four samples will be collected per property (on a quarterly basis), if there were 20 properties in each of the four categories, this would result in a total of 80 measurements, which should result in an acceptable limit on the width of the uncertainty bounds around the long-term average value.

3.7.2 Estimating the Required Analytical Sensitivity for Indoor Air

For the purposes of this effort, the analytical sensitivity that is needed for analysis of indoor air samples should be sufficient to ensure reliable detection and quantification if risks from ABS air approach or exceed a level of health concern. The choice of the level of concern is complicated by the fact that residents and workers in Libby may be exposed to asbestos by more than one pathway, and hence risk management decisions must consider the total (cumulative) risk from all pathways combined. With this in mind, the target level of concern for the indoor air pathway alone is set at a cancer risk of 1E-05 (1 in 100,000) or a non-cancer HQ of 0.1. That is, the target sensitivity is selected such that, if the true concentration of LA in indoor air corresponds to a risk that could contribute risk 1/10 the total level of concern (1E-04), the concentrations in air would be readily detectable and quantifiable with good confidence. If the true concentration corresponds to a risk that is less than 1/10 the total level of concern, exact quantification of the pathway becomes less important. The concentration of LA in indoor air that is associated with a risk level of 1E-05 is derived from the basic risk equations described above, simply by solving for the concentration that yields a risk of 1E-05:

$$1E\text{-}05 = C(air) \cdot TWF\ D\ UR$$
$$C(air) = 1E\text{-}05 / (TWF \cdot UR)$$

Note that the type of fibers included in this concentration is defined by the risk model. For example, the current EPA approach is based on phase contrast microscopy (PCM) fibers, which are defined as asbestos fibers longer than 5 micrometers (um), thicker than 0.25 um, and with an aspect ratio greater than 3:1. For convenience, the fibers used in a risk model are called "risk-based fibers".

In most cases, the risk-based fibers are only a sub-set of the total asbestos fibers present in air. The fraction of fibers that are risk-based is referred to as the "risk-based fraction" (RBF):

RBF = C(risk-based) / C(total)

At the Libby site, current analytical methods focus on measuring the concentration of total fibers, and sufficient data have accumulated to estimate the RBF with good accuracy. Thus, the concentration of PCM fibers may be calculated from a measure of total fibers as follows:

C(risk=based) = C(total) · RBF

This approach provides an estimate of the concentration of risk-based fibers that has lower statistical uncertainty than if only risk-based fibers were measured, and may be applied to any risk model that may be of interest.

Based on this approach, the concentration of concern of total asbestos associated with a specified risk level (1E-05) is calculated as follows:

Concentration of Concern (Total TEM s/cc) = (1E-05) / (RBF · TWF · UR)

where:

TEM = transmission electron microscopy

For planning purposes, it is conservatively assumed that the TWF for exposure to indoor air is 1.0. This value corresponds to continuous exposure (24 hours per day, 365 days per year) for a lifetime. It is considered likely that most residents will have indoor air exposures in Libby that are less than this assumption.

Based on EPA's currently recommended cancer risk model (IRIS 2007), the unit risk factor for lifetime exposure is 0.23 per phase-contrast microscopy (equivalent) (PCME) f/cc. Based on particle size data from the Libby Site, the fraction of total LA fibers in air that are PCME fibers is about 0.45. Thus, the concentration of concern for total LA in outdoor ABS air would be about:

Concentration of cancer concern (1E-05 risk level) = (1E-05) / (1.0 · 0.45 · 0.23) = 0.0001 s/cc

As noted above, the EPA has not yet developed a method for evaluating non-cancer risks from asbestos, so it is not yet possible to compute an analogous level of concern for non-cancer effects. In the absence of data, it is tentatively assumed that the target analytical sensitivity that

is adequate for evaluating cancer risk will also be sufficient for evaluating non-cancer risks. EPA toxicologists are currently working to develop an reference concentration (RfC) for asbestos based on available data on LA and other forms of asbestos, and this assumption will be re-visited when an RfC is approved for use.

Ideally, it would be desirable to select a target sensitivity somewhat lower than 0.0001 cc^{-1} in order to account for potential future revisions in the risk assessment approach for asbestos as new data are obtained and as new models are developed. However, because the personal air samples collected during this effort will be characterized by relatively low air volumes [(10 liters per minute (L/min) · 60 minutes per hour (min/hr) · 4 hours (hrs) = 2400 liters (L)], the number of grid openings (GOs) that require analysis in order to achieve a lower target analytical sensitivity (e.g., 0.00004 cc^{-1}) is rather large (about 400 GOs per sample). Recognizing that the total number of air samples to be analyzed as part of this program is large (20 properties per soil category x 4 soil categories x 4 samples per property x 2 activity types per sampling event = 640), the number of GOs needed for this number of samples (a total of more than 250,000) is considered to be impractical. Indeed, even a target sensitivity of 0.0001 cc^{-1} requires 160 GOs per sample for a total of over 100,000 GOs, which may still be difficult to achieve.

In the event that this total number of GOs is judged to be impracticable, a Monte Carlo simulation was performed to determine the relative statistical penalty imposed by either a) selecting an increase in target sensitivity, or b) selecting a decrease in total number of samples collected per category. Three cases were considered:

Case	Number of samples per category	Target Sensitivity $(cc)^{-1}$	GOs Required per Sample	Total GOs Required
1	100	0.0001	160	103,000
2	50	0.0001	160	51,000
3	100	0.0002	80	51,000

Notes: GO – grid openings

All cases assume that the set of samples collected over time from each of the properties in a soil category may be combined into a single data set for the purposes of estimating the average concentration and the 95% UCL of the mean. The calculations also assume that between-sample variability is relatively large (GSD = 8), and that the average indoor air concentration is about 0.0002 total LA s/cc (the target analytical sensitivity).

Figure 3-3 plots the distributions of the ratio of the 95% UCL of the mean (calculated by fitting each Monte Carlo simulated data set to a Poisson lognormal distribution, as described above)

divided by the true mean. The ideal distribution of UCL values would have about 5% of the distribution to the left of the vertical line at 1.0 (i.e., the UCL is lower than the true mean 5% of the time), and the distribution of UCL values to the right of the line would be as narrow as possible (to limit the occurrence of false positive errors). As seen, using Case 1 as the frame of reference, the effect of decreasing sample number (Case 2) results in a considerable increase in the width of the distribution of UCL values, while reducing the analytical sensitivity (Case 3) results in only a small increase in the distribution width. These results indicate that data quality would be substantially impaired by decreasing sample number, but only slightly impaired by increasing analytical sensitivity. For this reason, the target analytical sensitivity is set to 0.0002 cc^{-1}. If the data generated using this sensitivity are subsequently judged to be insufficient, analysis of additional grid openings from each sample may be performed, as needed to gain improved analytical sensitivity.

3.7.3 Estimating the Required Analytical Sensitivity for Indoor Dust

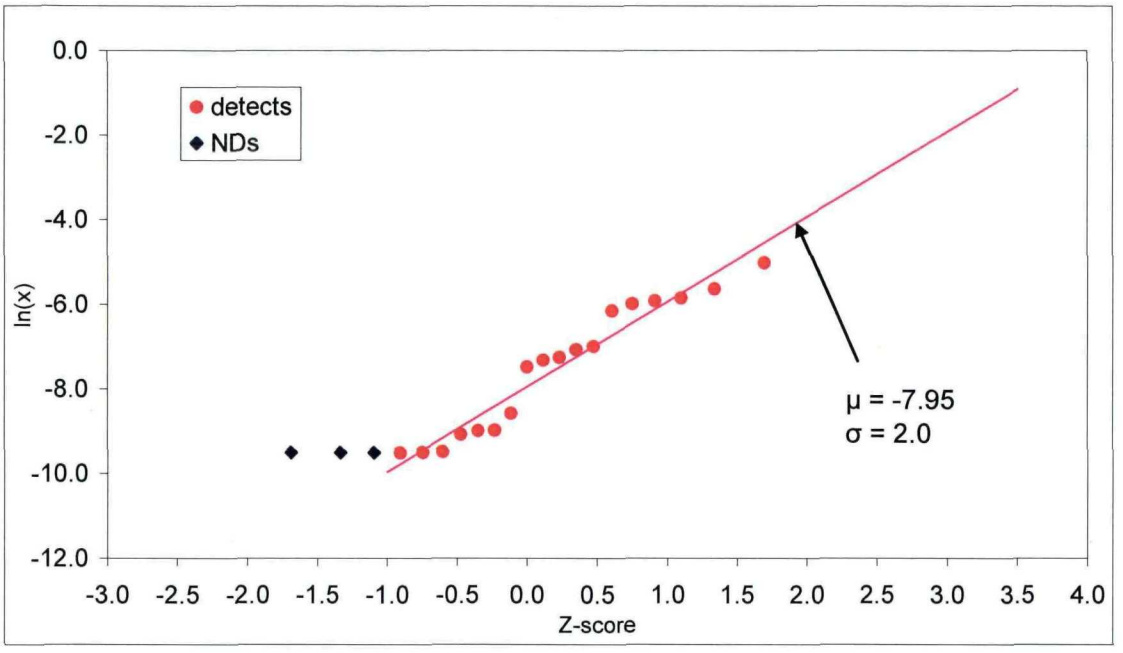
If a quantitative relationship between LA in indoor dust and in indoor air were established, this could be used to calculate a risk-based concentration of LA in indoor dust, and this could be used to select a target analytical sensitivity for dust. While screening level values for dust to air relationships are available from the literature (e.g., see EPA 2003), studies at Libby have not yet provided any firm basis for identifying a reliable site-specific dust-to-air transfer factor. Thus, in the absence of such a risk-based approach, a target analytical sensitivity of 20 cm^{-2} is selected for dust samples collected during this effort. This value is at the low end of what is considered practical (requiring analysis of about 50-100 GOs per sample). It is also suspected that dust levels below about 20 s/cm^2 are likely to be of relatively low concern as a source of indoor air contamination.

3.7.4 Refinements to the Design as Data are Collected

In accord with EPA's DQO process, it is expected that the indoor air monitoring program described in this document may be modified periodically as data are obtained. For example, if data suggest that the variability in concentrations over time is low, then EPA may decrease the number of samples collected over a specified period of time. Alternatively, if data suggest that the variability in concentrations is higher than expected, then additional samples may be added to better limit the uncertainty in the values. Similarly, the target analytical sensitivity may be either increased or decreased, depending on the detection frequency, mean values, and sample variability observed in initial samples results, and on the RfC value when it becomes available. Finally, the design may be revised if new methods for evaluating cancer or non-cancer effects are developed and approved for use by EPA.

FIGURE 3-1
LOG-PROBABILITY PLOTS OF PERSONAL INDOOR AIR SAMPLES

Panel A: Routine Activity



Panel B: Active Cleaning

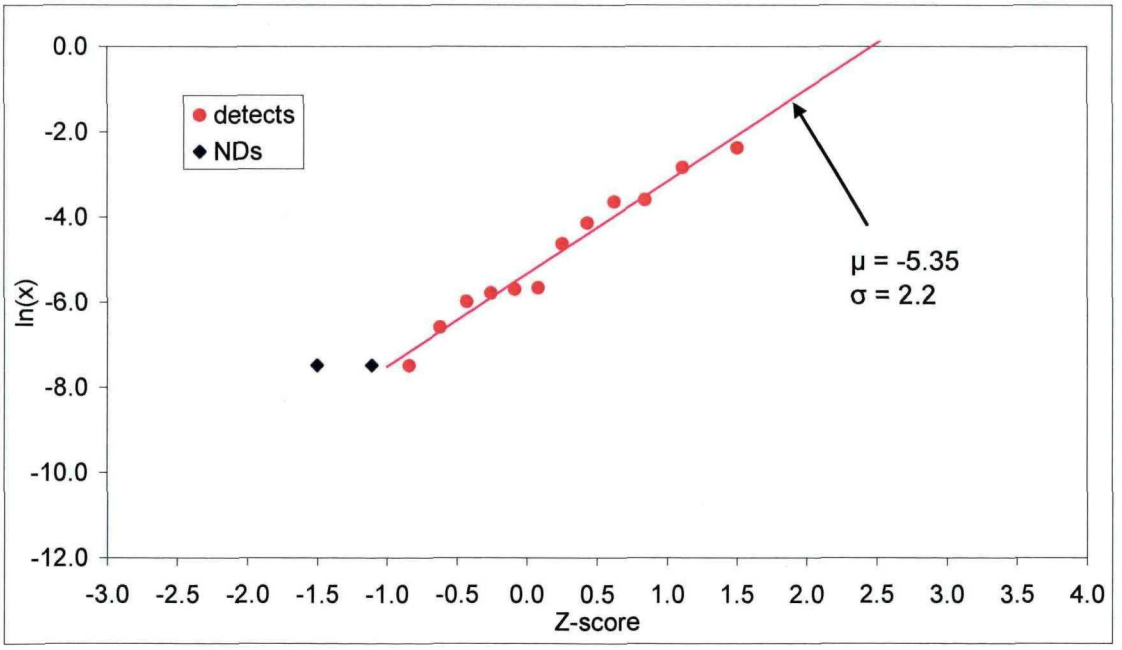
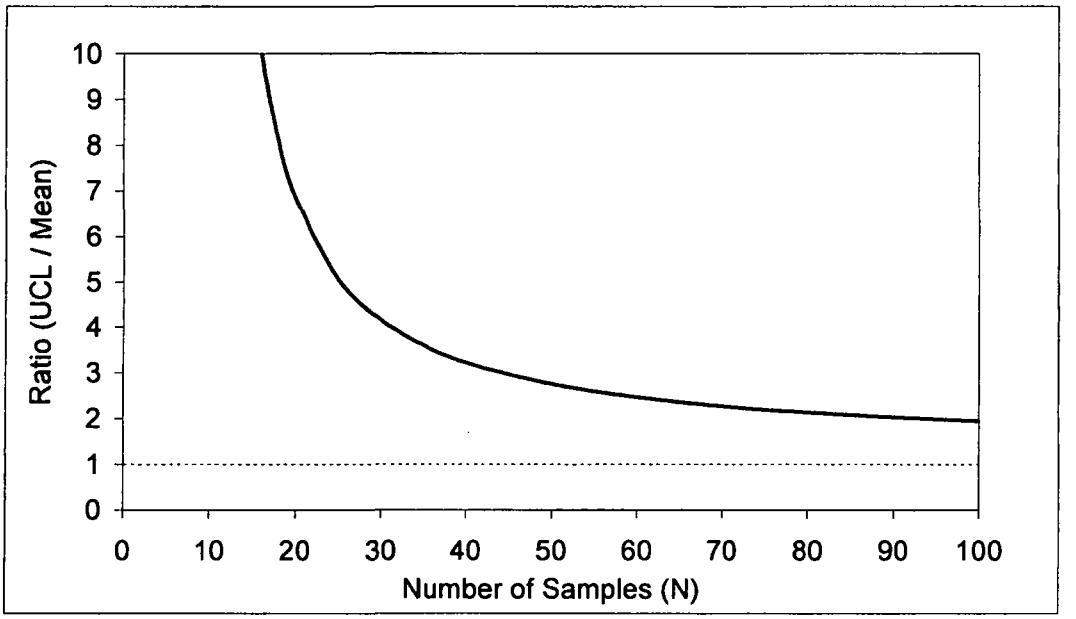


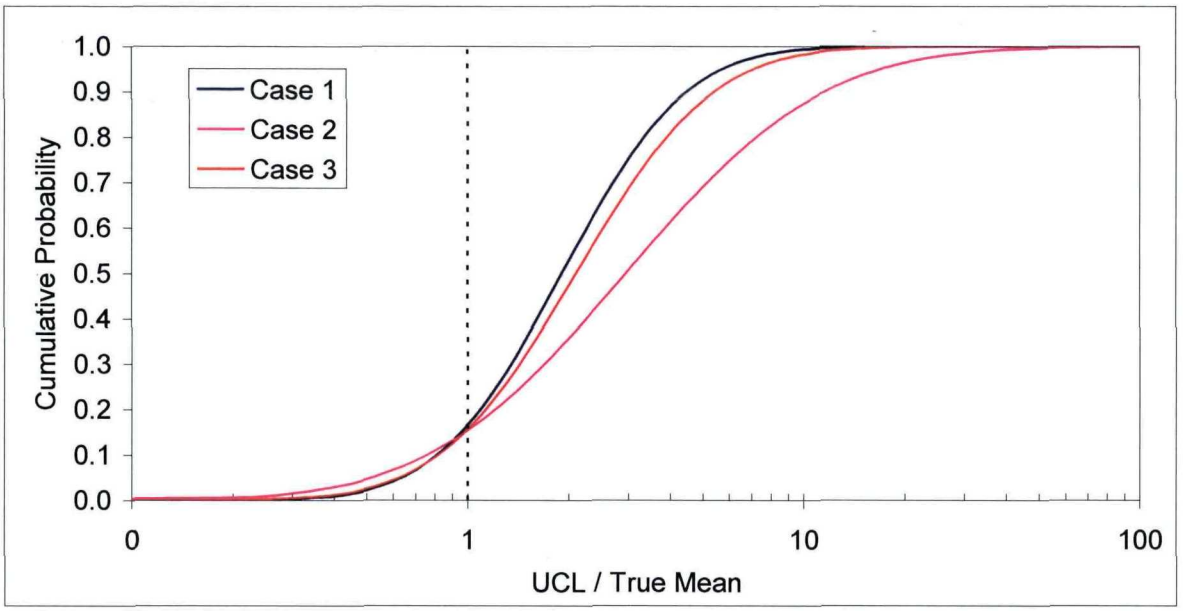
FIGURE 3-2
EXAMPLE UNCERTAINTY IN THE MEAN
OF A LOGNORMAL DATA SET WITH Σ = 2.0



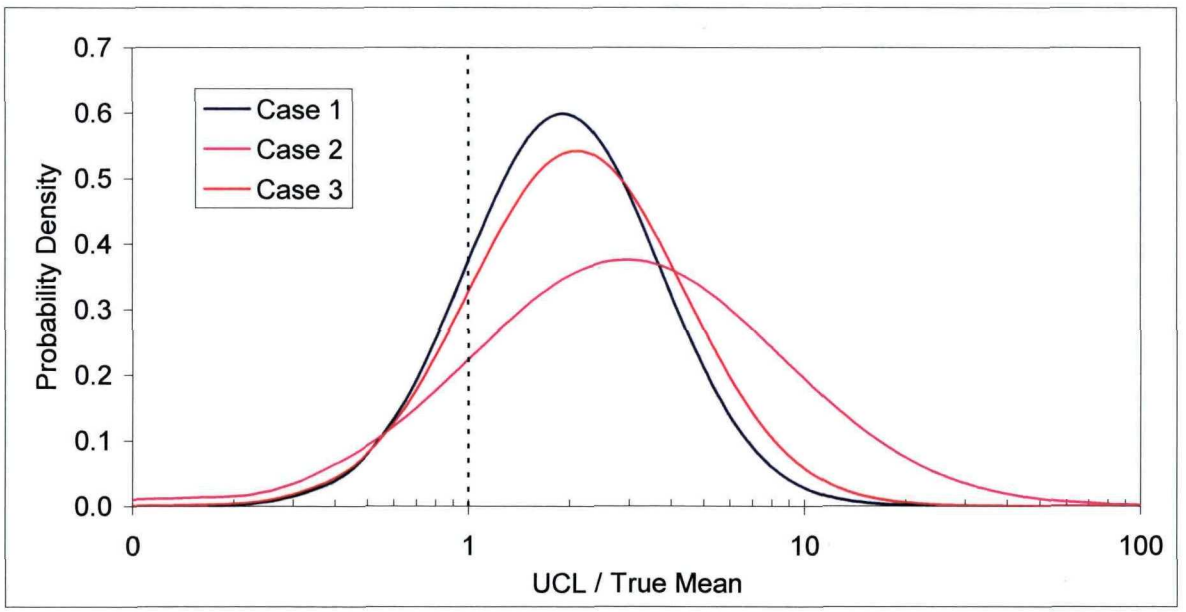
Notes: UCL – upper confidence limit

FIGURE 3-3
EFFECT OF DECREASING SAMPLE NUMBER OR INCREASING ANALYTICAL SENSITIVITY ON DATA QUALITY

Panel A: CDFs



Pandl B: PDFs



Notes: UCL – upper confidence limit

4.0 SAMPLING PROGRAM

This section provides brief summaries of SOPs and additional site-specific detail that may not be discussed in the SOPs. All activities will be performed in accordance with this SAP. Site-specific sampling procedures will be followed during the indoor ABS investigation. Field personnel will refer to the SWQAPP (CDM 2007a) sections listed below for details regarding requirements referenced in this SAP:

SWQAPP Section Number	Section Title
3.1	Sample Collection
3.2.1	Drafting and Approval of Governing Documents
3.2.2	Field Planning Meetings
3.2.3	Field Team Training Requirements
3.2.4	Field Logbooks
3.2.5	Field Sample Data Sheets (FSDSs)
3.2.6	Investigation Specific Field Forms
3.2.7	Photographic Documentation
3.2.8	Global Positioning System (GPS) Point Collection
3.2.9	Field Equipment Maintenance
3.2.10	Handling Investigation Derived Waste (IDW)
3.2.11	Field Sample Custody and Documentation
3.2.12	Sample Packaging and Shipping
3.2.13	Modification Forms
3.2.14.1	Field Surveillances
3.2.14.2	Field Audits

The SOPs and site-specific procedures to be utilized during this sampling event are listed below and included in Appendix B:

- Sample Custody (Modified SOP 1-2)
- Packaging and Shipping of Environmental Samples (Modified SOP 2-1)
- Guide to Handling of Investigation-Derived Waste (Modified SOP 2-2)
- Field Logbook Content and Control (Modified SOP 4-1)
- Photographic Documentation of Field Activities (Modified SOP 4-2)

- Field Equipment Decontamination at Nonradioactive Sites (Modified SOP 4-5)
- Control of Measurement and Test Equipment (SOP 5-1)
- Sampling of Asbestos Fibers in Air (EPA-LIBBY-01) (EPA 2001)
- Site-Specific SOP for Soil Sample Collection (CDM-LIBBY-05, Revision 2)
- Site-Specific SOP for Semi-Quantitative Visual Estimation of Vermiculite in Soil (CDM-LIBBY-06, Revision 1) with modifications
- Site-Specific SOP for GPS Coordinate Collection and Handling (CDM-LIBBY-09, Revision 0)
- Site-Specific SOP for 30-Point Composite Microvacuum Dust Sample Collection (CDM-LIBBY-10, Revision 1) with modification

The following sections are a summary of field activities that will be performed in accordance with this SAP by CDM during the indoor ambient air sampling investigation.

4.1 Pre-Sampling Activities

Prior to beginning field activities, sampling locations will be selected, a field planning meeting will be conducted, and an inventory of supplies will be performed to determine procurement needs. The following sections discuss these pre-sampling activities.

4.1.1 Selection of Sampling Locations

As discussed in Section 3.3, it is important that the locations selected for evaluation be representative of the types and levels of residual sources that may remain at post-cleanup properties. The four main categories of property are:

Category	Did Outdoor Soil Cleanup Take Place?	Post-cleanup Surface Soil		
		VCS		PLM Detect
1	No	-	and	-
2		+	or	+
3	Yes	-	and	-
4		+	and	-

Notes: PLM-VE – polarized light microscopy-visual area estimation; VCS – vermiculite containing soil

The target number of homes in each category is 20 (80 total).To the extent possible, the 20 homes in each category should be selected to provide a reasonable spatial representation in OU4.

In order to achieve this objective, the list of all post-cleanup properties in OU4 will first be stratified according to the four categories above, and then into three different sub-areas (north, central, and south), as shown in Figure 4-1. CDM's Community Involvement Coordinator (CIC) will then contact the residents at the properties in each category in each sub-area to determine if they are willing to participate in this investigation. The objective is to obtain participation from 6-7 properties in each category from each area.

As noted above, additional data on the occurrence of LA in outdoor soil at each property will be collected as part of this effort, and these additional data will be utilized in the data analysis phase. If the data are available in a timely fashion, they may also be used to help ensure that the homes selected for study provide a representative set of LA levels in post-cleanup soils.

4.1.2 Community Coordination

Prior to the implementation of the sampling events described in this SAP, the owner of each property where sampling is proposed will be contacted to determine his/her desire to participate in this investigation. The property owner will be advised of the study's duration (at least a year and perhaps longer), sampling frequency, and will be informed of the importance of obtaining samples consistently over that extended time period. Residents will be asked to not engage in cleaning activities for one week prior to the sampling event. Access agreements will be obtained as required.

4.1.3 Field Planning Meeting

A field planning meeting will be conducted in accordance with the procedures detailed in Section 3.2.2 of the SWQAPP (CDM 2007a).

4.1.4 Training Requirements

Training requirements described in Section 3.2.3 of the SWQAPP (CDM 2007a) will apply to personnel conducting sample collection activities described in this SAP.

4.1.5 Inventory and Procurement of Equipment and Supplies

The following equipment will be required for sampling activities, and any required equipment not already contained in the field equipment supply inventory will be procured prior to initiation of sampling activities:

- Field logbooks
- Indelible ink pens
- Digital camera

- Air sample media: 0.8 um pore, 25 millimeter (mm) diameter mixed cellulose ester (MCE) filter cassettes
- Dust sample media: 0.45 um pore, 25 mm diameter MCE filter cassettes
- Sample paperwork and sample tags/labels
- Custody seals
- Zipper-top baggies
- Personal air sampling equipment
- Personal protective equipment (PPE) as required by the site Health and Safety Plan (HASP)

4.2 Sample Collection

4.2.1 Indoor Air Sampling

As discussed above, this effort is focused on collection of personal air samples rather than stationary air samples. Because wearing personal air samplers is not convenient, rather than requesting residents to submit to this approach, EPA will use contractor staff to wear the personal air monitors. Participating residents will be required to leave the house during the time period of indoor sample collection.

Each home sampled will have two 4-hour samples collected to represent indoor air levels during two categories of activity: passive and active.

Period 1 (Passive Behaviors)
In this 4-hour interval, the EPA contractor will engage in minimal physical activity. Movement will be restricted to walking between rooms and sitting on upholstered chairs and/or cushions. While seated, the EPA contractor may read, watch television, or complete required paperwork.

Period 2 (Active Behaviors)
In this 4-hour interval, the contractor will engage in a standardized sequence ("script") of "active" behaviors, as detailed in Appendix C. This script is intended to capture a wide range of different activities that residents may engage in during normal living conditions. This includes things such as walking between rooms, sitting down on chairs and couches, simulated play with children or pets, sweeping, vacuuming, and dusting.

In order to ensure that each 4-hour sample is spatially representative of the home, each sample shall be collected from multiple rooms on all floors of the home. Therefore, prior to beginning sample collection, each residential structure will be assessed to determine the number of rooms

on each regularly occupied floor of the main structure where sampling will be conducted. This information will also be captured in the ABS Property Background and Sampling Form included in Appendix A. The total sampling time for each period (passive and active) will be divided evenly among the total number of rooms in which routine living activities occur (i.e., smaller rooms such as closets, utility rooms, bathrooms will not be included). For example, if the home is comprised of a basement that contains 2 rooms (e.g., 1 bedroom, 1 home gym) and a ground floor that contains 6 rooms (e.g., 1 living room, 1 dining room, 1 kitchen, and 3 bedrooms), the total time of the active and passive sampling periods (4 hours each) would be divided evenly among the 8 rooms (240 minutes / 8 rooms = 30 minutes per room).

If it is necessary to relieve a participant from an activity, a relief (backup) participant will be properly suited in time to make the exchange. When the relief participant is ready, the activity participant will stop, remove the backpack or belt, pass it to the relief participant, and assist the relief participant with donning and adjusting the backpack or belt. The exchange is anticipated to take less than 60 seconds, so the sampling pumps and event time clock will not be halted during the exchange. If the exchange requires more than 60 seconds, the pump and event clock will be stopped until activity is re-initiated.

Depending on what is most convenient for the resident, sampling will either occur over one 8-hour time interval, divided into two sub-periods of 4-hours each, or else will occur by collecting two 4-hour samples on two sequential days. If both samples are collected on one day, the passive activity sample will be collected in the morning, and the active sample will be collected in the afternoon to minimize the likelihood of cross-contamination between activity periods. If samples are collected on two sequential days, the order of collection may be random. That is, if the active phase is conducted in the morning of the first day at House #1 then the passive phase of sampling will be conducted at House #1 in the afternoon on the second day.

Two personal air samples will be collected during each 4 hour sub-period, one to serve as a backup in case the other fails, is damaged, or lost. The flow rates for sample collection should be 10 and 3.5 L/min resulting in target volumes of 2,400 and 840 L, respectively. These flow rates were chosen for this sampling event in order to maximize the volume of air collected which in turn helps achieve the analytical sensitivities required for risk assessment evaluations. For all asbestos sampling, an asbestos sampling train consisting of 0.8 um, 25 mm MCE filter connected to a sampling pump will be used. The top cover from the cowl extension on the sampling cassette shall be removed ("open-face") and the cassette oriented face down.

Both the high volume and low volume samples will be submitted to the laboratory for analysis. If the higher volume sample is not readable by TEM after a direct preparation method, either the lower flow sample may be evaluated for analysis by direct preparation, or the higher flow sample

may be used by applying an indirect sample preparation technique. *The laboratory must consult with EPA in order to select which is the most appropriate approach to follow.*

Indoor air sampling will be conducted in accordance with SOP EPA-LIBBY-01, Revision 1 (see Appendix B), except where modified in this SAP.

Pump Fault and Flow-Rate Error Procedures

Pump flow rates will be verified at 60 minute intervals or when participants are relieved from an activity by a backup participant, whichever occurs sooner. If at anytime the observed flow rates are ±10% of the target rate, the sampling pump should be re-calibrated. If at anytime an air sampling pump is found to have faulted or the observed flow rates are 30% below or 50% above the target rate, Figure 4-2 should be consulted to determine the appropriate action. The time elapsed from the start of the activity until the fault/flow observation will be used to determine the appropriate action according to Figure 4-2.

To calculate the percentage of an observed flow to the target flow, the following formula is used:

$$X\% = \frac{Observed\ Flow\ Rate\ (L/min)}{Target\ Flow\ Rate\ (L/min)} \cdot 100$$

Figure 4-3 illustrates the number of grid openings that will require analysis to achieve the target sensitivity (0.0002 cc^{-1}) when the flow is 10 L/min and there is a pump fault before two hours have elapsed.

4.2.2 Indoor Dust Sampling

At each property included in this effort, one composite indoor dust sample will be collected using the microvacuum method described in CDM-LIBBY-10, Revision 1 (Appendix B), with the following modification:

- 10 composite points will be collected with an optimal ratio of subsample locations of 4 accessible areas, 4 infrequently accessed areas, and 2 inaccessible areas

These samples will be collected from the same rooms where the EPA contractor performs the "active" and "passive" activities described above. Note that each sample may be collected on multiple cassettes if filter overloading and reduced pump rate is detected. Dust collection shall occur before the start of the first activity period.

4.2.3 Outdoor Soil Sampling

At each property included in this effort, one 30-point composite soil sample will be collected to represent all SUAs. All 30 sub-samples will be approximately equal in size (mass), collected in accordance with the Site-Specific SOP for Soil Sample Collection (CDM-LIBBY-05, Revision 2).

At each property included in this effort, a second composite soil sample will be collected to represent all NSUAs. Each NSUA composite sample will contain 30 sub-samples, distributed approximately evenly throughout the NSUA portions of the property.

In order to ensure that sufficient sample is available for potential future investigations, the mass of each composite sample must be no less than 2.0 kilograms (kg).

In addition, a sketch of the outdoor yard will be prepared that indicates the approximate locations and size of each SUA, the approximate location and level of any visible vermiculite in the yard, and the approximate locations of all sub-samples used to represent SUAs and NSUAs. This should be done in accord with the Site-Specific Standard Operating Procedure for Semi-Quantitative Visual Estimation of Vermiculite in Soil (CDM-LIBBY-06, Revision 1) with the following modifications:

- All areas of the property will be divided into zones and inspected for visual vermiculite regardless of previous excavations or presence of LA
- Interior surfaces (e.g., crawlspace, shed floor) will not be inspected for visual vermiculite

When possible, outdoor soil sampling and observations should occur close to the time that the first round of indoor air samples are collected. However, when necessary, the outdoor soil data may collected at a different time, since it is not expected that LA levels in outdoor soil vary substantially over time. Sampling will only be conducted in association with the first round of indoor sampling, and will not be required for subsequent sampling rounds.

4.2.4 MET Station Data

During days when indoor ABS activities are occurring, meteorological (MET) weather station data will be downloaded from the local National Oceanic Atmospheric Administration (NOAA) station, LBBM8. The following parameters are recorded hourly at this station:

- temperature (degrees Fahrenheit [°F])
- dew point (°F)
- relative humidity (%)

- wind speed (miles per hour [mph])
- wind gust (mph)
- wind direction
- solar radiation (watts per square meter per hour [watts/m^2 per hour])
- precipitation (inches)

Copies of all MET station data will be provided to EPA and SRC within one week of collection. Electronic copies have been determined to be suitable and will be placed in the project e-room.

4.3 General Processes

4.3.1 Equipment Decontamination

Decontamination of air sampling pumps and soil sampling equipment will be conducted as described in Section 3.1.1.2 of the SWQAPP (CDM 2007a).

4.3.2 Sample Labeling and Identification

Sample index identification numbers will identify the samples collected during this study by having the following format:

IN-#####

where:

IN = Interior ABS
= a sequential five digit number

4.3.3 Videotape Documentation

A videotape will be prepared to document a representative example of each activity including any special conditions or circumstances that arose during the activity. File names will be in the format:

last name of property owner_address_IABS_date

where:

IABS = Interior ABS
Date = MM_DD_YY

4.3.4 Field Logbooks

Field logbooks will be completed and managed as described in Section 3.2.4 of the SWQAPP (CDM 2007a). CDM SOP 4-1, Field Logbook Content and Control including project-specific modification is provided in Appendix B. Copies of all logbook entries will be provided to EPA and SRC within one week of collection. Electronic copies are suitable and will be placed in the project e-room within one week after the completion of each sampling event.

4.3.5 FSDSs

FSDSs will be completed and managed as described in Section 3.2.5 of the SWQAPP (CDM 2007a). Appendix D contains copies of the specific FSDSs that will be used to record information for samples collected during the activities described in this SAP. Copies of FSDSs will be provided to EPA and SRC within one week of collection. Electronic copies are suitable and will be placed in the project e-room within one week after the completion of each sampling event.

4.3.6 Photographic Documentation

Photographs will be collected, documented, and managed as described in Section 3.2.7 of the SWQAPP (CDM 2007a). CDM SOP 4-2, Photographic Documentation of Field Activities including project-specific modification is provided in Appendix B. Photographs will be used to document areas where indoor activities are conducted. File names will be in the format:

last name of property owner_address_IABS_date

where:

IABS = Interior ABS
Date = MM_DD_YY

4.3.7 GPS Point Collection

GPS location coordinates will be collected for soil samples as described in Section 3.2.8 of the SWQAPP (CDM 2007a) and in accordance with CDM-LIBBY-09, provided in Appendix B. Coordinates for buildings will be collected only if the building does not already have an assigned GPS location.

4.3.8 Field Equipment Maintenance

Air sampling pump calibrations will be conducted and documented as described in Section 3.1.1.2 of the SWQAPP (CDM 2007a). Field equipment maintenance will be conducted and

documented as described in Section 3.2.9 of the SWQAPP (CDM 2007a). CDM SOP 5-1, Control of Measurement and Test Equipment, is provided in Appendix B.

4.3.9 Handling IDW

IDW will be managed as described in Section 3.2.10 of the SWQAPP (CDM 2007a). CDM SOP 2-2, Guide to Handling of IDW, including a project-specific modification is provided in Appendix B.

4.3.10 Field Sample Custody and Documentation

Field Sample Custody and documentation will follow the requirements described in Section 3.2.11 of the SWQAPP (CDM 2007a). CDM SOP 1-2, Sample Custody, including a project-specific modification is provided in Appendix B. Copies of all chain-of-custody (COCs) forms will be provided to EPA and SRC within one week of collection. Electronic copies are suitable and will be placed in the project e-room within one week after the completion of each sampling event.

4.3.11 Sample Packaging and Shipping

Sample packaging and shipping will follow the requirements described in Section 3.2.12 of the SWQAPP (CDM 2007a). CDM SOP 2-1, Packaging and Shipping of Environmental Samples, including a project-specific modification is provided in Appendix B.

4.3.12 Modification Forms

All deviations will be documented and recorded according to the requirements described in Section 3.2.13 of the SWQAPP (CDM 2007a). A copy of the modification form is provided in Appendix E.

4.3.13 Field Surveillances and Audits

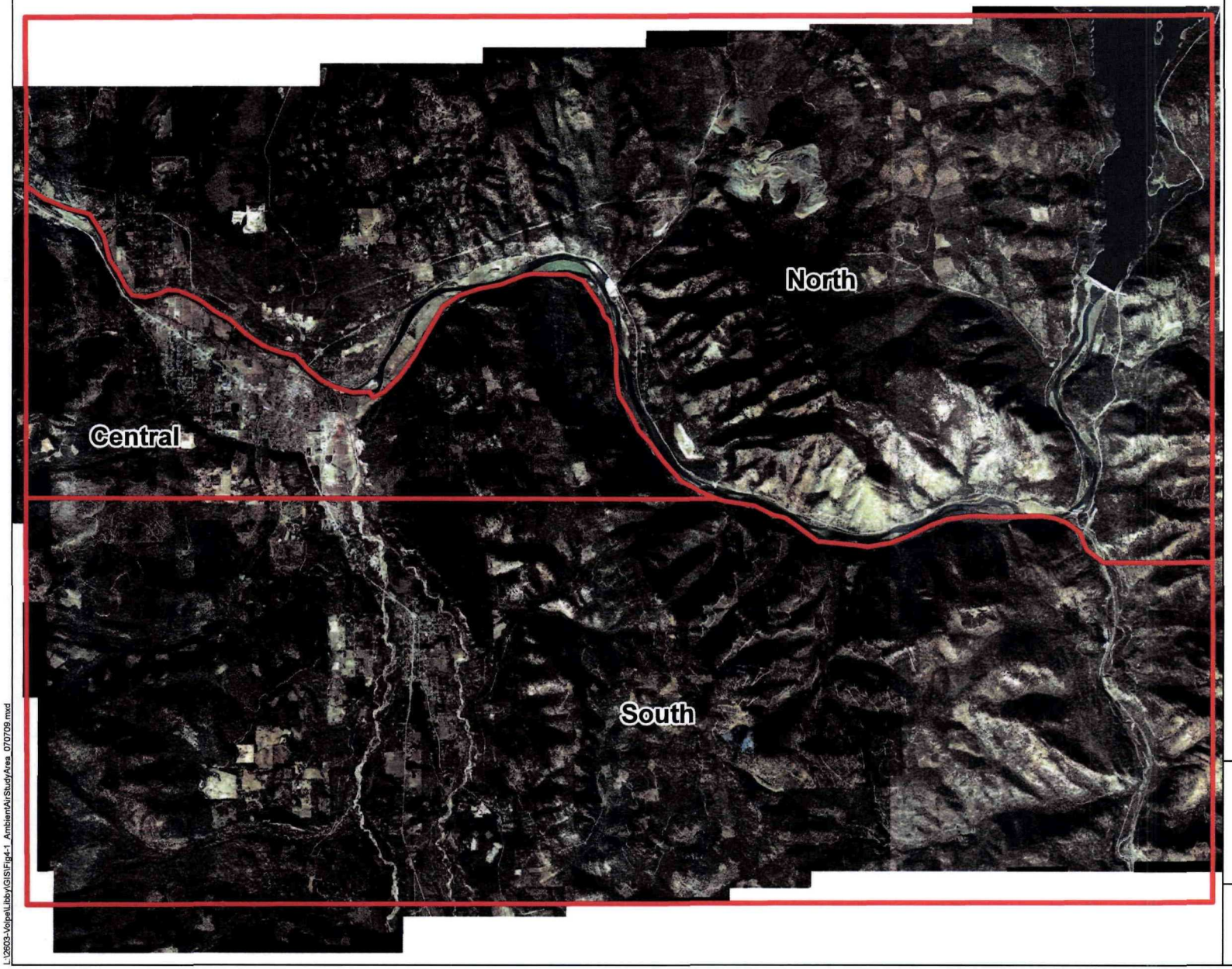
Field surveillances and audits will be conducted according to the requirements described in Section 3.2.14 of the SWQAPP (CDM 2007a).

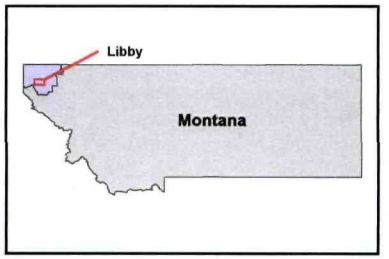
4.4 Quality Assurance/Quality Control (QA/QC) Activities

The QA/ QC actions required for each process described in this SAP will follow the requirements described in the SWQAPP (CDM 2007a).

4.4.1 Collection of QA/QC Field Samples

QA/QC samples will be collected according to the procedures described in the SWQAPP (CDM 2007a). All QA/QC field samples will be collected at the frequencies described in the SWQAPP with the exception of the frequency of drying blanks, co-located samples, and field blanks for air samples. It is expected that drying air sample cassettes will not be required for this activity. One field blank for dust samples and one field blank for air samples will be collected at each property per day when activities are conducted. All field blanks collected as part of this program will be analyzed by counting a number of grid openings that is approximately equal to the number of grid openings that are analyzed for field samples. Co-located samples will not be collected as one high volume sample and one low volume sample will be collected simultaneously. Table 4-1 summarizes the QA/QC sample collection and analysis frequencies for the indoor ABS investigation.





Note:
The OU boundaries depicted are based on the definitions found in the Libby Asbestos Conceptual Site Model. Because investigation of the nature and extent of contamination continues, the OU boundaries are subject to change. These OU boundaries are current as of June 4, 2007.

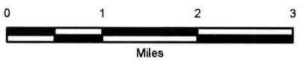


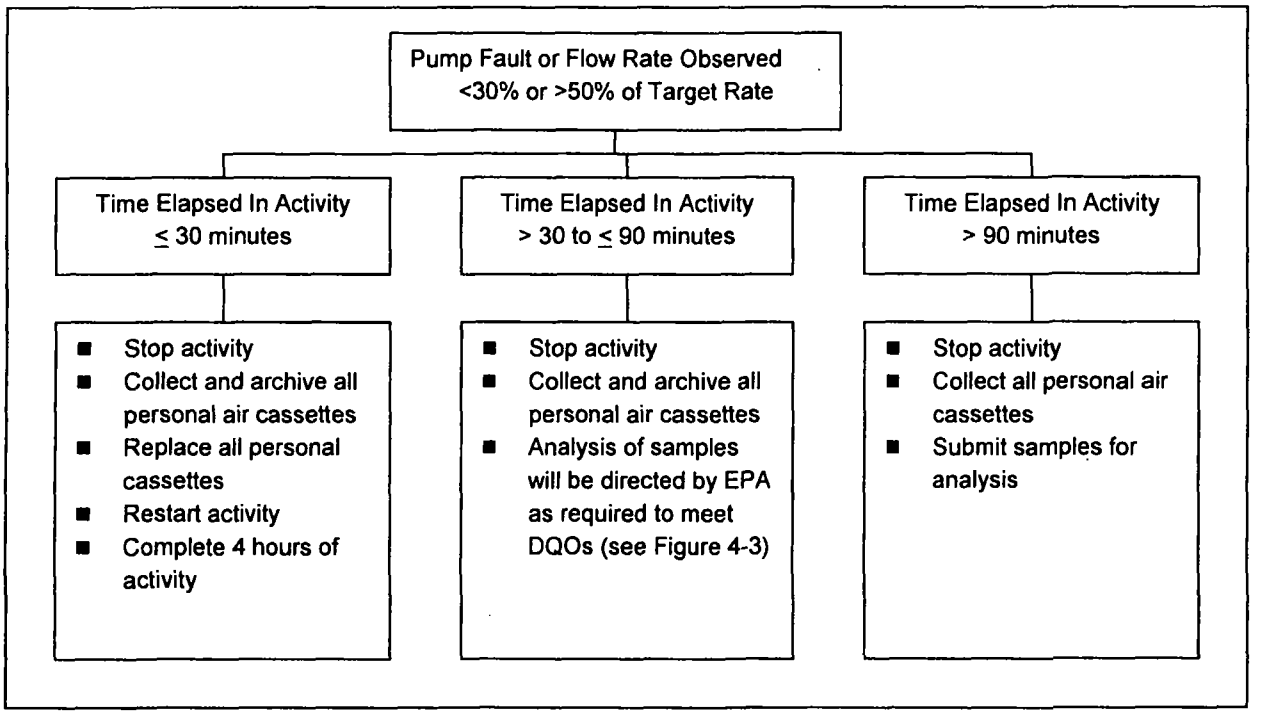
Figure 4-1
Study Area Boundaries

Libby, Montana

CDM

L:\2603-Volpe\Libby\GIS\Fig4-1_AmbientAirStudyArea_070709.mxd

FIGURE 4-2
PROCEDURES FOR PUMP FAULT AND FLOW-RATE ERRORS



Notes: < - less than; > - greater than; ≤ - less than or equal to; % - percent; DQOs – data quality objectives

FIGURE 4-3
EFFECT OF PUMP TIME ON GRID OPENINGS REQUIRED

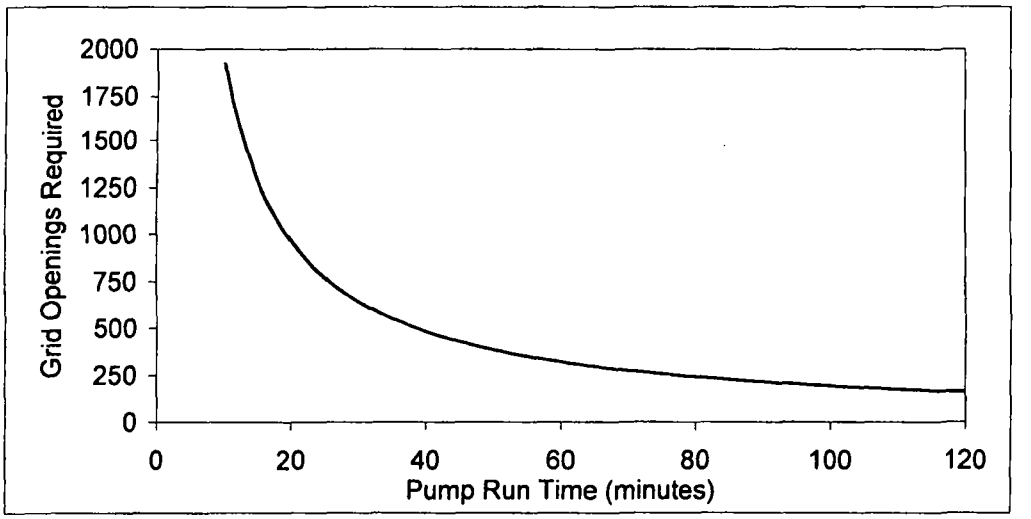


Table 4-1 Summary of Field QC Samples by Media

Media	Sample Type	Minimum Collection Frequency	Minimum Analysis Frequency	Acceptance Criteria	Acceptance Criteria Failure Action
Air	Lot Blank	1 per 500 cassettes	100%	ND for all asbestos	Rejection of all cassettes in lot
	Field Blank	1 per property per day	10% of total collected per week	ND for all asbestos fibers	Analysis of additional field blanks to determine source of potential cross-contamination, qualification of sample results, evaluation of field sample handling procedures
Dust	Lot Blank	1 per 300 cassettes	100%	ND for all asbestos	Rejection of all cassettes in lot
	Field Blank	1 per property per day	10% of total collected per week	ND for all asbestos fibers	Analysis of additional field blanks to determine source of potential cross-contamination, qualification of sample results, evaluation of field sample handling procedures
Soil	Field Duplicate	1 per 20 samples	100%	>90% RPD	Evaluation of sample collection techniques

Notes: QC - quality control; ND - nondetect; RPD - relative percent difference; COC - chain of custody

5.0 LABORATORY ANALYSIS AND REQUIREMENTS

All laboratories that analyze samples collected as part of this project must participate in and have satisfied the certification requirements in the last two proficiency examinations from the National Institute of Standards and Technology/National Voluntary Laboratory Accreditation Program (NVLAP). The laboratory must also analyze performance evaluation samples when requested. These analyses must be performed before any samples are submitted to the laboratory to confirm the laboratory's capabilities and may be subsequently submitted at regular intervals. In addition, the laboratory must participate in the laboratory training program developed by the Libby laboratory team.

5.1 Analytical Methods

5.1.1 Air and Dust

All indoor air and indoor dust samples will be submitted to a subcontracted laboratory for analysis using the International Organization for Standardization (ISO) TEM method 10312, also known as ISO 10312:1995(E) (CDM 2003a) with project specific modifications LB-000016, LB-000019, LB-000028, LB-000029, LB-000029a, LB-000030, LB-000053, and LB-000066b (CDM 2003b). All asbestos structures (including not only Libby amphibole but all other asbestos types as well) that have appropriate diffraction patterns and EDS spectra, and having length greater than or equal to 0.5 um and an aspect ratio $\geq$ 3:1, will be recorded on the Libby site-specific laboratory data sheets and electronic deliverables.

The target analytical sensitivity for air samples is 0.0002 cc^{-1}. The target analytical sensitivity for dust samples is 20 s/cm^2. All air and dust field blanks collected as part of this program will be analyzed by counting a number of grid opens that is approximately equal to the number of rid openings that are analyzed for field samples. For air, this is expected to be about 80 grid openings.

As described in the latest version of laboratory modification LB-000029, the frequency for laboratory-based QC samples for TEM analysis is:

- Lab blank = 4%
- Recount same = 1%
- Recount different = 2.5%
- Re-preparation = 1%
- Verified analysis = 1%
- Inter-laboratory = 0.5%

5.1.2 Soil

All soil samples collected as part of this effort will be analyzed by PLM in accord with SOPs SRC-LIBBY-01, Revision 2 and SRC-LIBBY-03, Revision 2.

5.1.3 Sample Archival

All air samples will be distributed to a project laboratory for analysis. Both the high volume and low volume samples will be sent to the same laboratory. Once analyzed, all samples will be stored (archived) at the laboratory under COC until further notice.

Aliquots of soil not sent for analysis will be archived at the Soil preparation Laboratory in accord with standard practice, as detailed in the latest version of the Close Support Facility Soil Preparation Plan.

5.2 Analytical Sensitivity for TEM Analyses

5.2.1 Indoor Air Samples

As discussed in Section 3.1, the target analytical sensitivity for indoor air samples is 0.0002 cc^{-1}. In the event of sample loading or other issues where a sensitivity of 0.0002 cc^{-1} can not be achieved, the laboratory may report a sample result with a higher (poorer) sensitivity only after consultation with EPA project personnel and preparation of a temporary modification form.

5.2.2 Indoor Dust Samples

The target analytical sensitivity for indoor dust samples collected as part of this effort will be 20 s/cm^2. This level is sufficient that it will allow reasonable quantification of dust concentration across the wide range of values (from <20 up to a maximum of 5,000 s/cm^2) expected to exist in the various residences.

5.3 Holding Times

No preservation requirements or holding times are established for air samples collected for asbestos analysis.

5.4 Laboratory Custody Procedures and Documentation

Laboratory custody procedures and documentation will be completed as required by the specifications detailed in Section 4.5 of the SWQAPP (CDM 2007a).

5.5 Documentation and Records

Laboratory documentation and records will be completed as required by the specifications detailed in Section 4.7 of the SWQAPP (CDM 2007a).

5.6 Data Management

Sample results data will be delivered to the Volpe Center and CDM's Cambridge office both in hard copy and as an electronic data deliverable (EDD). Electronic copies of all project deliverables, including graphics, will be filed by project number. Electronic files will be routinely backed up and archived.

All results, field data sheet information, and survey forms will be maintained in the Libby project database managed by the Volpe Center under the oversight of the Volpe Center database management team.

6.0 ASSESSMENT AND OVERSIGHT

Assessments and oversight reports to management are necessary to ensure that procedures are followed as required and that deviations from procedures are documented. These reports also serve to keep management current on field activities. Assessment, oversight reports, and response actions are discussed below.

6.1 Assessments

Performance assessments are quantitative checks on the quality of a measurement system and are appropriate to analytical work. Performance assessments for the laboratories may be accomplished by submitting reference material as blind reference (or performance evaluation) samples. These assessment samples have known concentrations of LA that are submitted to the laboratories blind (i.e., without informing the laboratories that they are performance evaluation samples). Laboratory audits may be conducted upon request from the EPA Team leader (TL) or Volpe Center project manager (PM).

System assessments are qualitative reviews of different aspects of project work to check on the use of appropriate QC measures and the functioning of the QA system. Project assessments will be performed under the direction of the QA managers, who report directly to the CDM president. Quality Procedure 6.2, as defined in the CDM QA Manual (CDM 2007b), defines CDM 's corporate assessments, procedures, and requirements. Due to the amount of sampling and the duration of the Libby project, both a field audit and an office audit are scheduled for the Site annually.

6.2 Response Actions

Response actions will be implemented on a case-by-case basis to correct quality problems. Minor response actions taken in the field to immediately correct a quality problem will be documented in the applicable field logbook and a verbal report will be provided to the CDM PM. For verbal reports, the CDM PM will complete a communication log to document the response actions were relayed to him/her. Major response actions taken in the field will be approved by the CDM PM, the EPA TL, and Volpe PM prior to implementation of the change. Major response actions are those that may affect the quality or objective of the investigation. Quality problems that cannot be corrected quickly through routine procedures may require implementation of a corrective action request (CAR) form.

All formal response actions will be submitted to either CDM 's QA manager and/or project QA coordinator for review and issuance. CDM 's PM or local QA coordinator will notify the QA

manager when quality problems arise that may require a formal response action. CAR forms will be completed according to Quality Procedure 8.1 of the CDM QA Manual (CDM 2007b). In addition, when modifications to this specific SAP are required, either for field or laboratory activities, a Libby Asbestos Project Record of Modification Form (Appendix E) must be completed.

6.3 Reports to Management

QA reports will be provided to management whenever quality problems are encountered. Field staff will note any quality problems on field data sheets, or in field logbooks. CDM 's PM will inform the project QA coordinator upon encountering quality issues that cannot be immediately corrected. Weekly reports and change request forms are not required for this work assignment. Monthly QA reports will be submitted to CDM 's QA manager by the project QA coordinator.

Topics to be summarized regularly may include but not be limited to:

- Document technical and QA reviews that have been conducted
- Activities and general program status
- Project meetings
- Corrective action activities
- Any unresolved problem
- Any significant QA/QC problems not included above

7.0 DATA VALIDATION AND USABILITY

Laboratory results will be reviewed for compliance with project objectives. Data validation and evaluation are discussed in Sections 7.1 and 7.2, respectively.

7.1 Data Review, Validation, and Verification Requirements

Data review, validation, and verification will be performed for important investigative samples as described in the SWQAPP. Data validation, review, and verifications must be performed on sample results before distribution to the public for review. Requirements for the frequency of data review are initially set at 10%. This initial rate may be revised as initial samples are analyzed and results evaluated.

Data validation consists of examining the sample data package(s) against pre-determined standardized requirements. The validator may examine, as appropriate, the reported results, QC summaries, case narratives, COC information, raw data, initial and continuing instrument calibration, and other reported information to determine the accuracy and completeness of the data package. During this process, the validator will verify that the analytical methodologies were followed and QC requirements were met. The validator may recalculate selected analytical results to verify the accuracy of the reported information. Analytical results will then be qualified as necessary.

Data verification includes checking that results have been transferred correctly from laboratory data printouts to the laboratory report and to the EDD. Data verification for this project is primarily performed as a function of built-in quality control checks in the Libby project database when data is uploaded. However, the sample coordinator will notify the laboratories and the project database manager (Mr. Mark Raney, Volpe Center) of any discrepancies found during data usage.

7.2 Reconciliation with Data Quality Objectives

Once data has been generated, CDM evaluates data to determine if DQOs were achieved. This achievement will be discussed in the measurement report, including the data and any deviations to this SAP. Sample data will be maintained in the project database (Libby2). Laboratory QC sample data will be stored in hard copy (in the project files) and in Libby2.

8.0 PROJECT SCHEDULE

It is anticipated that initial outdoor assessments to determine locations for indoor ABS sample collection will begin in May 2007. The first event of indoor ABS sampling is currently planned to be conducted from July 2007 to August 2007. It is anticipated that results from this round of sampling will be available for tabulation and release for public review in October 2007.

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APPENDIX A
ACTIVITY-BASED SAMPLING PROPERTY BACKGROUND AND SAMPLING FORM

BD#_____

LIBBY ASBESTOS PROJECT
Activity-Based Sampling (ABS)
Property Background and Sampling Form

Address:_____

Resident:_____ Phone Number:_____

Owner (if different than occupant):_____ Phone Number:_____

Data Item	Value	Notes
ABS Category (completed after receipt of soil sample results) (Circle all that apply)	Int1: VCS- and PLM- Int2: VCS+ and/or PLM + Int3: Exterior Removal and VCS- Int4: Exterior Removal and VCS+ N/A	Ext1: Clean fill Ext2: VCS- and PLM- Ext3: VCS+ and PLM- Ext4: PLM Bin B1 Ext5: PLM Bin B2
Primary Structure Description and Resident Information Primary structure descriptions and resident information were gathered from a verbal interview conducted on _____ by _____. All data below were provided by the resident during the interview. Section Check Completed By:_____		
Number of Floors Above Ground	1 2 3 Other:_____	
Understructure (Circle all that apply)	Basement: Living Space Non-Living Space Crawlspace N/A	If basement is both a living/non-living space- specify percentage of each:
Wood Stove	Is there a wood stove? Yes No	If so, is it used? Yes No
Heating Source	Wood/Coal Electric Propane/Gas Oil Other:_____	
Heat Distribution	Forced air Radiant Other:_____	
Carpeting	Approximate age of carpet per floor: 1:_____ 2:_____ 3:_____ BSMT:_____ *Choose age from the following categories* <5 5-10 10-20 20+	Additional Comments:

ABS Property Background and Sampling Form (continued)

Address:_____

Data Item	Value	Notes
Was the residence/building remodeled?	Yes No If yes, When (years): <2 2-5 >5 Where: Attic Living Areas Garage Basement Other:_____	
Is there any knowledge of former miners, close relatives of miners, or any highly exposed persons living or visiting the property?	Yes No	Explanation:
Is the resident, past or present, diagnosed with an asbestos-related disease?	Yes No Unknown	If unknown, why?
Total number of occupants	_____	Explanation of part-time occupants:
Age and number of occupants	Age: 0-5 5-12 12-18 18-35 35-60 60+ ___ ___ ___ ___ ___ ___	
Number and type of pets	Dogs:_____ Cats:_____ Other: _____ _____	Are pets indoor only, outdoor only, or both?
Are the windows kept open during the day when weather conditions permit?	Yes No	During what approximate temperature range?
Do you regularly use a vacuum equipped with a HEPA filter? *(if applicable)*	Yes No N/A	
During the passive phase of the sampling, may we use your radio or television?	Yes No	Additional comments/restrictions on use:

Property Background and Sampling Form (continued)

Address:_____

Are there any additional restrictions on activities performed at the property? (e.g., rooms prohibited from accessing, items not to be disturbed, firearms, scheduling requests {day of the week, start time, split days}, etc.)

_____

_____

_____

_____

_____

_____

_____

_____

Interior Contamination- *Data summarized from IFF. Additional indoor inspections for vermiculite were not conducted as a part of the ABS investigation.*

Section Check Completed By:_____ ❒ **Attached completed IFF to this form**

Current location of indoor vermiculite (Circle all that apply)	Attic Walls Crawlspace None Visual in Living Space: Basement, Ground Floor, Second Floor, Attached Garage Other:_____	If in living space, provide specific location:
Are there vermiculite additives in any of the building materials?	Yes No	Type and location of building material:

Removal History- *Data summarized from PCC.*

Section Check Completed By:_____ ❒ **Attached completed PCC to this form**

Has EPA performed an interior remediation at the property?	Yes No	In what year(s)?
Has EPA performed an exterior remediation at the property?	Yes No	In what year(s)?
Location of clean fill (Circle all that apply)	Driveway Flowerbed Garden Yard Stockpile None N/A Other: _____	Approximate location:

Property Background and Sampling Form (continued)

Address:_____

Outdoor Characterization ❒ Outdoor Characterization Date Completed:_____ Section Check Completed By:_____ ❒ **Attached completed VVEF to this form** Field Logbook: _____ Page Number(s):_____ Team Members:_____		
Location of outdoor vermiculite (Circle all that apply)	Driveway Flowerbed Garden Yard Stockpile None Other_____	Visual vermiculite override needed? Yes No
Are there known areas of the property with LA? (previously sampled)	Yes No	Location:
Samples collected from (circle all that apply)	NSUA SUA	
Indoor Characterization ❒ Indoor Characterization Date Completed:_____ Section Check Completed By:_____		
Square Footage of House		
Number of Rooms Per Floor	1:_____ 2:_____ 3:_____ Basement:_____	
Square Footage of Rooms on Ground Floor	Name of Room / Square Footage _____ _____ _____ _____ _____ _____ _____ _____ _____ _____	Name of Room / Square Footage _____ _____ _____ _____ _____ _____ _____ _____ _____ _____
Square Footage of Rooms on Second Floor (if applicable)	Name of Room / Square Footage _____ _____ _____ _____ _____ _____ _____ _____ _____ _____	Name of Room / Square Footage _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

Property Background and Sampling Form (continued)

Address:_____

Square Footage of Rooms in Basement (if applicable)	Name of Room	Square Footage	Name of Room	Square Footage
	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
Percentage of each floor covered by carpet	1:_____%			
	2:_____%			
	3:_____%			
	BSMT:_____%			

Indoor ABS Event 1 ❒ Indoor ABS- Event 1 Date Completed:_____

Section Check Completed By:_____

Field Logbook: _____ Page Number(s):_____ Team Members:_____

Activity Summary	Passive / Active	Comments (schedule delays)
	Passive Date:_____ AM PM	
	Active Date:_____ AM PM	
Total number of samples collected:	Air: _____ FB: _____	
	Dust: _____ FD: _____ FB: _____	

Outdoor ABS Event 1 ❒ Outdoor ABS- Event 1 Date Completed:_____

Section Check Completed By:_____

Field Logbook: _____ Page Number(s):_____ Team Members:_____

	Day 1		Day 2 (if applicable)	
Scenario Area 1 Soil Condition Data	100%	Moderately coarse texture	100%	Moderately coarse texture
	75-100%	Medium texture	75-100%	Medium texture
	50-75%	Fine and very fine texture	50-75%	Fine and very fine texture

Scenario Area 1 Ground Cover and Soil Texture	Grass _____%	Bare soil _____%	USDA Soil Texture:
	Mulch _____%	Rocks _____%	

Scenario Area 1 Activity Summary	Raking	Mowing	Child's Play
	Date:_____ AM PM	Date:_____ AM PM	Date:_____ AM PM
Soil Category:_____			

Property Background and Sampling Form (continued)

Address:_____

Total number of samples collected:	Air: _____ FB: _____ Soil: _____ FD: _____	
Indoor ABS Event 2 ❒ Indoor ABS- Event 2 Date Completed:_____ Section Check Completed By:_____ Field Logbook: _____ Page Number(s):_____ Team Members:_____		
Activity Summary	Passive Active Date:_____ Date:_____ AM PM AM PM	Comments (schedule delays)
Total number of samples collected:	Air: _____ FB: _____ Dust: _____ FD: _____ FB: _____	
Indoor ABS Event 3 ❒ Indoor ABS- Event 3 Date Completed:_____ Section Check Completed By:_____ Field Logbook: _____ Page Number(s):_____ Team Members:_____		
Activity Summary	Passive Active Date:_____ Date:_____ AM PM AM PM	Comments (schedule delays)
Total number of samples collected:	Air: _____ FB: _____ Dust: _____ FD: _____FB: _____	
Indoor ABS Event 4 ❒ Indoor ABS- Event 4 Date Completed:_____ Section Check Completed By:_____ Field Logbook: _____ Page Number(s):_____ Team Members:_____		
Activity Summary	Passive Active Date:_____ Date:_____ AM PM AM PM	Comments (schedule delays)
Total number of samples collected:	Air: _____ FB: _____ Dust: _____ FD: _____FB: _____	

Property Background and Sampling Form (continued)

Address:_____

Outdoor ABS Event 2 ❒ Outdoor ABS- Event 2 Date Completed:_____ Section Check Completed By:_____ Field Logbook: _____ Page Number(s):_____ Team Members:_____		
Scenario Area 1 Soil Condition Data	Day 1 100% Moderately coarse texture 75-100% Medium texture 50-75% Fine and very fine texture	Day 2 (if applicable) 100% Moderately coarse texture 75-100% Medium texture 50-75% Fine and very fine texture
Scenario Area 1 Ground Cover and Soil Texture	Grass _____% Bare soil _____% Mulch _____% Rocks _____%	USDA Soil Texture:
Scenario Area 1 Activity Summary Soil Category:_____	Raking Mowing Child's Play Date:_____ Date:_____ Date:_____ AM PM AM PM AM PM	
Total number of samples collected:	Air: _____ FB: _____ Soil: _____ FD: _____	

ADDITIONAL INFORMATION

Address:_____

FIELD DIAGRAM OF PROPERTY

Identify important features (i.e. trees, structures, flowerbeds, utility poles, sample locations, etc). **Include north arrow.**

- Sketch of the yard to illustrate location and size of any area with visible vermiculite along with the relative amount observed.
- Approximate location and size of any SUA
- Approximate locations of all sub-samples used to represent SUAs and NSUAs
- Location of previously excavated and backfilled areas
- Approximate location and size of the ABS scenario area (index IDs and composite points of scenario area samples)
- The sketch should indicate the soil condition at the ABS scenario area, including the extent of vegetative cover and any other important visual features.
- Location of MET station

*Reinspect areas where removal has taken place for VCS and include as subsample for NSUA but use the surveyed property drawing if available.

APPENDIX B
STANDARD OPERATING PROCEDURES

Project-Specific Modification

SOP No.: 1-2

SOP Title: Sample Custody

Project: Libby Asbestos Remedial Investigation (RI)

Project No.: 3282-137

Client: U.S. Environmental Protection Agency

Project Manager: _____ Date: 5/7/03

Technical Reviewer: _____ Date: 5/7/03

QA Reviewer: _____ Date: 5/12/03

EPA Approval: _____ Date: 5/19/03

NOTE: Each media (soil/dust) must be submitted on separate COC forms.

The sample coordinator assistant will use the FSDS to complete an electronic chain of custody (eCOC). The sample coordinator will check the data entered to create the eCOC against the FSDSs. Three paper copies of the eCOC will then be generated. One copy will be filed in the CDM Libby office and the other two will be sent with the samples. The sample coordinator will then check the eCOC versus the sample containers and sample shipment. The sample coordinator will be responsible for shipment of samples. If any errors are found on an eCOC after shipment, the paper copy of the COC will be corrected by the sample coordinator with a single strikeout initial and date. The corrected copy will be faxed to Volpe and the laboratory. The fax to Volpe will be used to update the Libby project database.

Reason for and duration of modification: Sample custody procedures for the Libby asbestos project vary slightly from SOP 1-2. These modifications are necessary for the entire duration of the project.

Project-Specific Modification

Via: Hand delivery or shipped. Hand delivery refers to samples delivered by hand to the onsite laboratory; shipped refers to samples sent to the laboratory by delivery service (i.e., Federal Express). To be completed by the sample coordinator.

Project: All samples collected in accordance with this sampling and analysis plan (SAP) are part of the CSS. Circle CSS. To be completed by the field team.

Sample Placed in Cooler/Bag: Refers to visual confirmation of the sample in the shipping container. To be completed by the sample coordinator.

Index ID: Unique index identification number used to identify sample, in the form CSS-#####. To be completed by the field team.

Sample Date: The date each sample was collected, in the form MM/DD/YY. To be completed by the field team.

Sample Time: The time each sample was collected, in military time. To be completed by the field team.

Sample Matrix: The matrix of each sample collected, specific to the CSS; S = soil and W = water. To be completed by the field team.

Sample Type: Sample type of each sample collected; G = grab, C = composite. To be completed by the field team.

Volume: Specific to air and dust samples. Does not pertain to the CSS. "NA" should be placed in this field. To be completed by the field team.

Analysis Request: Analysis of each sample collected. All soil samples will be analyzed by IR. IR will be written in the analysis request portion of the COC form by the field team. The sample coordinator and/or laboratory coordinator may request SEM analysis based on Table 5-2 of the SAP. The sample coordinator and/or laboratory coordinator will designate IR for the appropriate samples.

Comments: Any pertinent information regarding the sample (i.e., vermiculite visible) will be entered by either the field team or the sample coordinator.

Sample Received by Lab: To be checked by the sample custodian at the laboratory upon receipt of the samples to confirm presence of each sample on the COC record.

Project-Specific Modification

Total Number of Samples: Total number of samples on the COC form. To be completed by the field team.

Additional Comments: Any additional comments that relate to samples on the COC form (i.e., turn around times). To be completed by the field team or sample coordinator.

Relinquished by: (1) Signed by field team member that relinquishes samples to sample coordinator and company of person relinquishing samples to sample coordinator (i.e., CDM). Date of relinquish shall be in the form MM/DD/YY and time shall be in military time. (2) Additional relinquished by lines to be completed following standard sample custody procedures.

Received by: (1) Signed by sample coordinator that receives samples from the sampling team and company of person accepting samples from the field teams (i.e., CDM). Date and time of acceptance should be the same as date and time of relinquish. (2) Additional received by lines to be completed following standard sample custody procedures.

Sample Condition upon Receipt: Will reflect the condition of samples at the relinquish time (i.e., accept ok or not acceptable with an explanation). To be completed by the person receiving samples.

Page ___ of ___: Sequential page number of the entire COC set sent to the laboratory. To be completed by the sample coordinator.

Sample Custody

SOP 1-2
Revision: 4
Date: March 1, 2004
Page 1 of 7

Prepared: David O. Johnson

Technical Review: Shelley Thibeault

QA Review: Laura Splichal

Approved: Michael C. Molloy 2/24/04
Signature/Date

Issued: 2/18/04
Signature/Date

1.0 Objective

Due to the evidentiary nature of samples collected during environmental investigations, possession must be traceable from the time the samples are collected until their derived data are introduced as evidence in legal proceedings. To maintain and document sample possession, sample custody procedures are followed. All paperwork associated with the sample custody procedures will be retained in CDM Federal Programs Corporation (CDM) files unless the client requests that it be transferred to them for use in legal proceedings or at the completion of the contract.

Note: Sample custody documentation requirements vary with the specific EPA region or client. This SOP is intended to present basic sample custody requirements, along with common options. Specific sample custody requirements should be presented in the project-specific quality assurance (QA) project plan or project-specific modification or clarification form (see Section U-1).

2.0 Background

2.1 Definitions

Sample - A sample is material to be analyzed that is contained in single or multiple containers representing a unique sample identification number.

Sample Custody - A sample is under custody if:

1. It is in your possession
2. It is in your view, after being in your possession
3. It was in your possession and you locked it up
4. It is in a designated secure area

Chain-of-Custody Record - A chain-of-custody record is a form used to document the transfer of custody of samples from one individual to another.

Custody Seal - A custody seal is a tape-like seal that is part of the chain-of-custody process and is used to detect tampering with samples after they have been packed for shipping.

Sample Label - A sample label is an adhesive label placed on sample containers to designate a sample identification number and other sampling information.

Sample Tag - A sample tag is attached with string to a sample container to designate a sample identification number and other sampling information. Tags may be used when it is difficult to physically place adhesive labels on the container (e.g., in the case of small air sampling tubes).

3.0 Responsibilities

Sampler - The sampler is personally responsible for the care and custody of the samples collected until they are properly transferred or dispatched.

Field Team Leader - The field team leader (FTL) is responsible for ensuring that strict chain-of-custody procedures are maintained during all sampling events. The FTL is also responsible for coordinating with the subcontractor laboratory to ensure that adequate information is recorded on custody records. The FTL determines whether proper custody procedures were followed during the fieldwork and decides if additional samples are required.

Field Sample Custodian - The field sample custodian, when designated by the FTL, is responsible for accepting custody of samples from the sampler(s) and properly packing and shipping the samples to the laboratory assigned to do the analyses. A field sample custodian is typically designated only for large and complex field efforts.

4.0 Required Supplies

- Chain-of-custody records (applicable client or CDM forms)
- Sample labels or tags
- Custody seals
- Clear tape

5.0 Procedures

5.1 Chain-of-Custody Record

This procedure establishes a method for maintaining custody of samples through use of a chain-of-custody record. This procedure will be followed for all samples collected or split samples accepted.

Field Custody

1. Collect only the number of samples needed to represent the media being sampled. To the extent possible, determine the quantity and types of samples and sample locations prior to the actual fieldwork. As few people as possible should handle samples.

2. Complete sample labels or tags for each sample using waterproof ink.

3. Maintain personal custody of the samples (in your possession) at all times until custody is transferred for sample shipment or directly to the analytical laboratory.

Transfer of Custody and Shipment

1. Complete a chain-of-custody record for all samples (see Figure 1 for an example of a chain-of-custody record. Similar forms may be used when requested by the client). When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents sample custody transfer from the sampler, often through another person, to the sample custodian in the appropriate laboratory.

    - The date/time will be the same for both signatures when custody is transferred directly to another person. When samples are shipped via common carrier (e.g., Federal Express), the

date/time will not be the same for both signatures. Common carriers are not required to sign the chain-of-custody record.

- In all cases, it must be readily apparent that the person who received custody is the same person who relinquished custody to the next custodian.
- If samples are left unattended or a person refuses to sign, this must be documented and explained on the chain-of-custody record.

Note: If a field sample custodian has been designated, he/she may initiate the chain-of-custody record, sign, and date as the relinquisher. The individual sampler(s) must sign in the appropriate block, but does (do) not need to sign and date as a relinquisher (refer to Figure 1).

2. Package samples properly for shipment and dispatch to the appropriate laboratory for analysis. Each shipment must be accompanied by a separate chain-of-custody record. If a shipment consists of multiple coolers, samples in the coolers may be recorded on a single chain-of-custody record.

3. The original record will accompany the shipment, and the copies will be retained by the FTL and, if applicable, distributed to the appropriate sample coordinators. Freight bills will also be retained by the FTL as part of the permanent documentation. The shipping number from the freight bill shall be recorded on the applicable chain-of-custody record.

Procedure for Completing CDM Example Chain-of-Custody Record
The following procedure is to be used to fill out the CDM chain-of-custody record. The record provided herein (Figure 1) is an example chain-of-custody record. If another type of custody record (i.e., provided by the EPA contract laboratory program or a subcontract laboratory) is used to track the custody of samples, the custody record should be filled out in its entirety.

1. Record project number.
2. Record FTL for the project (if a field sample custodian has been designated, also record this name in the "Remarks" box).
3. Record the name and address of the laboratory to which samples are being shipped.
4. Enter the project name/location or code number.
5. Record overnight courier's airbill number.
6. Record sample location number.
7. Record sample number.
8. Note preservatives added to the sample.
9. Note media type (matrix) of the sample.
10. Note sample type (grab or composite).
11. Enter date of sample collection.
12. Enter time of sample collection in military time.

Figure 1
Example CDM Chain-of-Custody Record

CDM

125 Maiden Lane, 5th Floor
New York, NY 10038
(212) 785-9123
Fax: (212) 785-6114

CHAIN OF CUSTODY RECORD

PROJECT ID.	FIELD TEAM LEADER	LABORATORY AND ADDRESS	DATE SHIPPED
PROJECT NAME/LOCATION		LAB CONTRACT:	AIRBILL NO.

MEDIA TYPE
1. Surface Water
2. Groundwater
3. Leachate
4. Field QC
5. Soil/Sediment
6. Oil
7. Waste
8. Other _____

PRESERVATIVES
1. HCl, pH <2
2. HNO3, pH <2
3. NaOH, pH >12
4. H2SO4, pH <2
5. Zinc Acetate, pH >9
6. Ice Only
7. Not Preserved
8. Other _____

SAMPLE TYPE
G = Grab
C = Composite

SAMPLE LOCATION NO.	LABORATORY SAMPLE NUMBER	PRESERVATIVES ADDED	MEDIA TYPE	SAMPLE TYPE	20__ DATE	TIME SAMPLED	ANALYSES (List no. of containers submitted)								REMARKS (Note if MS/MSD)
1.															
2.															
3.															
4.															
5.															
6.															
7.															
8.															
9.															
10.															

SAMPLER SIGNATURES:

RELINQUISHED BY: (PRINT)	DATE/TIME	RECEIVED BY: (PRINT)	DATE/TIME	RELINQUISHED BY: (PRINT)	DATE/TIME	RECEIVED BY: (PRINT)	DATE/TIME
(SIGN)		(SIGN)		(SIGN)		(SIGN)	
RELINQUISHED BY: (PRINT)	DATE/TIME	RECEIVED BY: (PRINT)	DATE/TIME	RELINQUISHED BY: (PRINT)	DATE/TIME	RECEIVED BY: (PRINT)	DATE/TIME
(SIGN)		(SIGN)		(SIGN)		(SIGN)	

COMMENTS:

DISTRIBUTION: White and yellow copies accompany sample shipment to laboratory; yellow copy retained by laboratory. Pink copy retained by samplers. 1/98

Note: If requested by the client, different chain-of-custody records may be used. Copies of the template for this record may be obtained from the Chantilly Graphics Department.

13. When required by the client, enter the names or initials of the samplers next to the sample location number of the sample they collected.
14. List parameters for analysis and the number of containers submitted for each analysis.
15. Enter matrix spike/matrix spike duplicate (MS/MSD) if sample is for **laboratory** quality control or other remarks (e.g., sample depth).
16. Sign the chain-of-custody record(s) in the space provided. All samplers must sign each record.
17. If sample tags are used, record the sample tag number in the "Remarks" column.
18. The originator checks information entered in Items 1 through 16 and then signs the top left "Relinquished by" box, prints his/her name, and enters the current date and time (military).
19. Send the top two copies (usually white and yellow) with the samples to the laboratory; retain the third copy (usually pink) for the project files. Retain additional copies for the project file or distribute as required to the appropriate sample coordinators.
20. The laboratory sample custodian receiving the sample shipment checks the sample label information against the chain-of-custody record. Sample condition is checked and anything unusual is noted under "Remarks" on the chain-of-custody record. The laboratory custodian receiving custody signs in the adjacent "Received by" box and keeps the copy. The white copy is returned to CDM.

5.2 Sample Labels and Tags

Unless the client directs otherwise, sample labels or tags will be used for all samples collected or accepted for CDM projects.

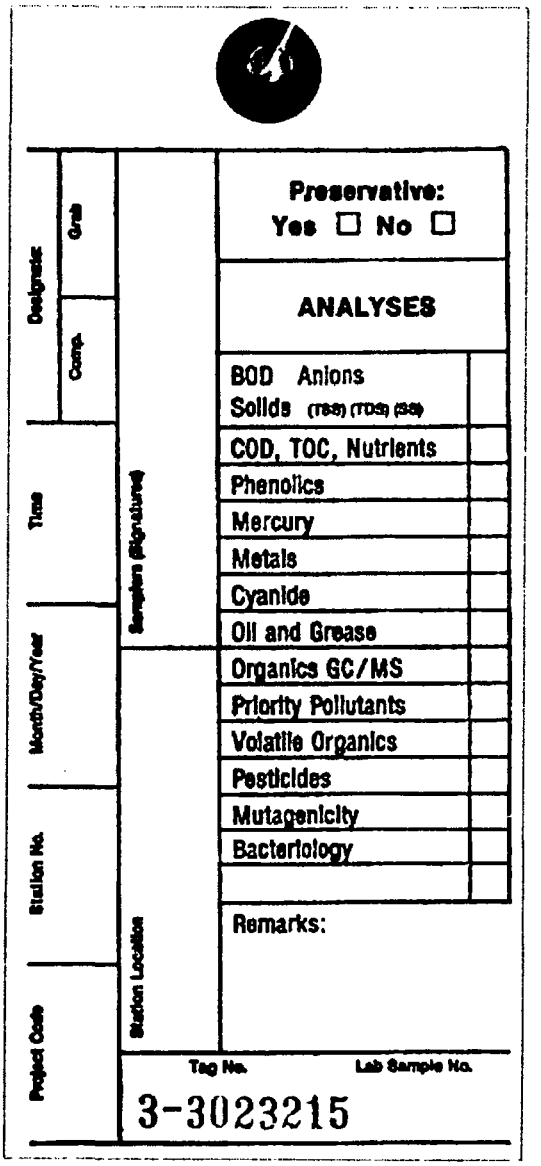
1. Complete one label or tag with the information required by the client for each sample container collected. A typical label or tag would be completed as follows (see Figure 2 for example of sample tag; labels are completed with the equivalent information):

   - Record the project code (i.e., project or task number).
   - Enter the station number (sample number) if applicable.
   - Record the date to indicate the month, day, and year of sample collection.
   - Enter the time (military) of sample collection.
   - Place a check to indicate composite or grab sample.
   - Record the station (sample) location.
   - Sign in the space provided.
   - Place a check next to "yes" or "no" to indicate if a preservative was added.
   - Place a check under "Analyses" next to the parameters for which the sample is to be analyzed. If the desired analysis is not listed, write it in the empty slot. **Note:** Do not write in the box for "laboratory sample number."
   - Place or write additional relevant information under "Remarks."

2. Place adhesive labels directly on the sample containers. Place clear tape over the label to protect from moisture.

3. Securely attach sample tags to the sample bottle. On 2.27 liter (80 oz.) amber bottles, the tag string may be looped through the ring style handle and tied. On all other containers, it is

Figure 2
Example Sample Tag



Note: Equivalent sample labels or tags may be used.

recommended that the string be looped around the neck of the bottle, then twisted and re-looped around the neck until the slack in the string is removed.

4. Double-check that the information recorded on the sample tag is consistent with the information recorded on the chain-of-custody record.

5.3 Custody Seals

Two custody seals must be placed on opposite corners of all shipping containers (e.g., cooler) prior to shipment. The seals should be signed and dated by the shipper.

Custody seals may also be placed on individual sample bottles. Check with the client or refer to EPA regional guidelines for direction.

5.4 Sample Shipping

The CDM standard operating procedure listed below defines the requirements for packaging and shipping environmental samples.

- *CDM Federal SOP 2-1, Packaging and Shipping Environmental Samples*

6.0 Restrictions/Limitations

Check with the EPA region or client for specific guidelines. If no specific guidelines are identified, this procedure should be followed.

For EPA Contract Laboratory Program (CLP) sampling events, combined chain-of-custody/traffic report forms or other EPA-specific records may be used. Refer to regional guidelines for completing these forms.

The EPA FORMS II Lite™ software may be used to customize sample labels and custody records when directed by the client or the CDM project manager.

7.0 References

U.S. Environmental Protection Agency, *EPA Guidance for Quality Assurance Project Plans*, EPA QA/G-5, EPA/600/R-98/018, February 1998, Section B3.

U.S. Environmental Protection Agency, *National Enforcement Investigations Center, Multi-Media Investigation Manual*, EPA-330/9-89-003-R, Revised March 1992, p.85.

U.S. Environmental Protection Agency, *Contract Laboratory Program (CLP), Guidance for Field Samplers*, EPA-540-R-00-003, Draft Final, June 2001, Section 3.2.

U.S. Environmental Protection Agency, *FORMS II Lite™ User's Guide*, March 2001.

U.S. Environmental Protection Agency, Region IV, *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*, May 1996, Section 3.3.

U.S. Army Corps of Engineers, *Requirements for the Preparation of Sampling and Analysis Plan*, EM 200-1-3, February 2001, Appendix F.

Project-Specific Modification

SOP No.: 2-1

SOP Title: Packaging and Shipping of Environmental Samples

Project: Libby Asbestos Remedial Investigation (RI)

Project No.: 3282-137

Client: U.S. Environmental Protection Agency

Project Manager: _____ Date: 5/7/03

Technical Reviewer: _____ Date: 5/7/03

QA Reviewer: _____ Date: 5/12/03

EPA Approval: _____ Date: 5/19/03

Reason for and duration of modification: Procedures for shipping environmental samples for the Libby asbestos project vary slightly from CDM Technical SOP 2-1. These modifications are necessary for the entire duration of the project.

Samples collected during this investigation will be packaged and shipped in accordance with CDM Technical SOP 2-1, with the following modifications:

Section 1.4, Required Equipment - Vermiculite (or other absorbent material), bubble wrap, or ice will not be used for packaging or shipping samples.

Section 1.5, Procedures - No vermiculite or other absorbent material will be used to pack the samples. No ice will be used.

Packaging and Shipping Environmental Samples

SOP: 2-1
Revision: 2
Date: March 1, 2004

Prepared: Krista Lippoldt
Technical Review: Chuck Myers
QA Review: Douglas J. Updike
Approved: Michael C. Molly 2/24/04
Signature/Date
Issued: 3/10/04
Signature/Date

1.0 Packaging and Shipping of All Samples

This standard operating procedure (SOP) applies to the packaging and shipping of all environmental samples. If the sample is preserved or radioactive, the following sections may also be applicable.

Section 2.0 - Packaging and Shipping Samples Preserved with Methanol
Section 3.0 - Packaging and Shipping Samples Preserved with Sodium Hydroxide
Section 4.0 - Packaging and Shipping Samples Preserved with Hydrochloric Acid
Section 5.0 - Packaging and Shipping Samples Preserved with Nitric Acid
Section 6.0 - Packaging and Shipping Samples Preserved with Sulfuric Acid
Section 7.0 - Packaging and Shipping Limited-Quantity Radioactive Samples

1.1 Objective

The objective of this SOP is to outline the requirements for the packaging and shipment of environmental samples. Additionally, Sections 2.0 through 7.0 outline requirements for the packaging and shipping of regulated environmental samples under the Department of Transportation (DOT) Hazardous Materials Regulations, the International Air Transportation Association (IATA), and International Civil Aviation Organization (ICAO) Dangerous Goods Regulations for shipment by air and applies only to domestic shipments. This SOP does not cover the requirements for packaging and shipment of equipment (including data loggers and self-contained breathing apparatus [SCBAs] or bulk chemicals that are regulated under the DOT, IATA, and ICAO.

1.2 Background

1.2.1 Definitions

Environmental Sample - An aliquot of air, water, plant material, sediment, or soil that represents the contaminant levels on a site. Samples of potential contaminant sources, like tanks, lagoons, or non-aqueous phase liquids are normally not "environmental" for this purpose. This procedure applies only to environmental samples that contain less than reportable quantities for any foreseeable hazardous constituents according to DOT regulations promulgated in 49 CFR - Part 172.101 Appendix A.

Custody Seal - A custody seal is a narrow adhesive-backed seal that is applied to individual sample containers and/or the container (i.e., cooler) before offsite shipment. Custody seals are used to demonstrate that sample integrity has not been compromised during transportation from the field to the analytical laboratory.

Inside Container - The container, normally made of glass or plastic, that actually contacts the shipped material. Its purpose is to keep the sample from mixing with the ambient environment.

Outside Container - The container, normally made of metal or plastic, that the transporter contacts. Its purpose is to protect the inside container.

Secondary Containment - The outside container provides secondary containment if the inside container breaks (i.e., plastic overpackaging if liquid sample is collected in glass).

Excepted Quantity - Excepted quantities are limits to the mass or volume of a hazardous material in the inside and outside containers below which DOT, IATA, ICAO regulations do not apply. The excepted quantity limits are very low. Most regulated shipments will be made under limited quantity.

Limited Quantity - Limited quantity is the maximum amount of a hazardous material below which there are specific labeling or packaging exceptions.

Performance Testing - Performance testing is the required testing of outer packaging. These tests include drop and stacking tests.

Qualified Shipper - A qualified shipper is a person who has been adequately trained to perform the functions of shipping hazardous materials.

1.2.2 Discussion

Proper packaging and shipping is necessary to ensure the protection of the integrity of environmental samples shipped for analysis. These shipments are potentially subject to regulations published by DOT, IATA, or ICAO. Failure to abide by these rules places both CDM and the individual employee at risk of serious fines. The analytical holding times for the samples must not be exceeded. The samples should be packed in time to be shipped for overnight delivery. Make arrangements with the laboratory before sending samples for weekend delivery.

1.2.3 Associated Procedure

- CDM Federal SOP 1-2, Sample Custody

1.3 Required Equipment

- Coolers with return address of the appropriate CDM office
- Heavy-duty plastic garbage bags
- Plastic zip-type bags, small and large
- Clear tape
- Nylon reinforced strapping tape
- Duct tape
- Vermiculite (or an equivalent nonflammable material that is inert and absorbent)*
- Bubble wrap (optional)
- Ice
- Custody seals
- Completed chain-of-custody record or contract laboratory program (CLP) custody records, if applicable
- Completed bill of lading
- "This End Up" and directional arrow labels

* Check for any client-specific or laboratory requirements related to the use of absorbent packaging materials.

1.4 Packaging Environmental Samples

The following steps must be followed when packing sample bottles and jars for shipment:

1. Verify the samples undergoing shipment meet the definition of "environmental sample" and are not a hazardous material as defined by DOT. Professional judgment and/or consultation with qualified persons such as the appropriate health and safety coordinator or the health and safety manager should be observed.

2. Select a sturdy cooler in good repair. Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler. Line the cooler with a large heavy-duty plastic garbage bag.

3. Be sure the caps on all bottles are tight (will not leak); check to see that labels and chain-of-custody records are completed properly (SOP 1-2, Sample Custody).

4. Place all bottles in separate and appropriately sized plastic zip-top bags and close the bags. Up to three VOA vials may be packed in one bag. Binding the vials together with a rubber band on the outside of the bag, or separating them so that they do not contact each other, will reduce the risk of breakage. Bottles may be wrapped in bubble wrap. Optionally, place three to six VOA vials in a quart metal can and then fill the can with vermiculite or equivalent. **Note:** Trip blanks must be included in coolers containing VOA samples.

5. Place 2 to 4 inches of vermiculite (or equivalent) into a cooler that has been lined with a garbage bag, and then place the bottles and cans in the bag with sufficient space to allow for the addition of packing material between the bottles and cans. It is preferable to place glass sample bottles and jars into the cooler vertically. Glass containers are less likely to break when packed vertically rather than horizontally.

6. While placing sample containers into the cooler, conduct an inventory of the contents of the shipping cooler against the chain-of-custody record. The chain-of-custody with the cooler should reflect only those samples within the cooler.

7. Put ice in large plastic zip-top bags (double bagging the zip-tops is preferred) and properly seal. Place the ice bags on top of and/or between the samples. Several bags of ice are required (dependant on outdoor temperature, staging time, etc.) to maintain the cooler temperature at approximately 4° Celsius (C) if the analytical method requires cooling. Fill all remaining space between the bottles or cans with packing material. Securely fasten the top of the large garbage bag with fiber or duct tape.

8. Place the completed chain-of-custody record or the CLP traffic report form (if applicable) for the laboratory into a plastic zip-top bag, seal the bag, tape the bag to the inner side of the cooler lid and close the cooler.

9. The cooler lid shall be secured with nylon reinforced strapping tape by wrapping each end of the cooler a minimum of two times. Attach a completed chain-of-custody seal across the opening of the cooler on opposite sides. The custody seals should be affixed to the cooler with half of the seal on the strapping tape so that the cooler cannot be opened without breaking the seal. Complete two more wraps around with fiber tape and place clear tape over the custody seals.

10. The shipping container lid must be marked **"THIS END UP"** and arrow labels that indicate the proper upward position of the container should be affixed to the cooler. A label containing the name and address of the shipper (CDM) shall be placed on the outside of the container. Labels used in the shipment of hazardous materials (such as Cargo Only Air Craft, Flammable Solids, etc.) are not permitted on the outside of containers used to transport environmental samples and shall not be used. The name and address of the laboratory shall be placed on the container, or when shipping by common courier, the bill of lading shall be completed and attached to the lid of the shipping container.

2.0 Packaging and Shipping Samples Preserved with Methanol

2.1 Containers

- The maximum volume of methanol in a sample container is limited to 30 ml.
- The sample container must not be full of methanol.

2.2 Responsibility

It is the responsibility of the qualified shipper to:

- Ensure that the samples undergoing shipment contain no other contaminant that meets the definition of "hazardous material" as defined by DOT
- Determine the amount of preservative in each sample so that accurate determination of quantities can be made

2.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3:

- Inner packing may consist of glass or plastic jars
- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test
- Survey documentation (if shipping from Department of Energy [DOE] or radiological sites)
- Class 3 flammable liquid labels
- Orientation labels
- Consignor/consignee labels

2.4 Packaging Samples Preserved with Methanol

The following steps are to be followed when packaging limited-quantity sample shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.

- At a minimum the label must contain:
  - Project name
  - Project number
  - Date and time of sample collection
  - Sample location
  - Sample identification number
  - Collector's initials
  - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody form)
- Wrap each container (40-ml VOA vials) in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place wrapped containers inside a polyethylene bottle filled with vermiculite; seal the bottle. (Maximum of 4 VOA vials will fit inside a 500-ml wide-mouth polyethylene bottle.)
- Total volume of methanol per shipping container must not exceed 500 ml.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tieing or taping.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

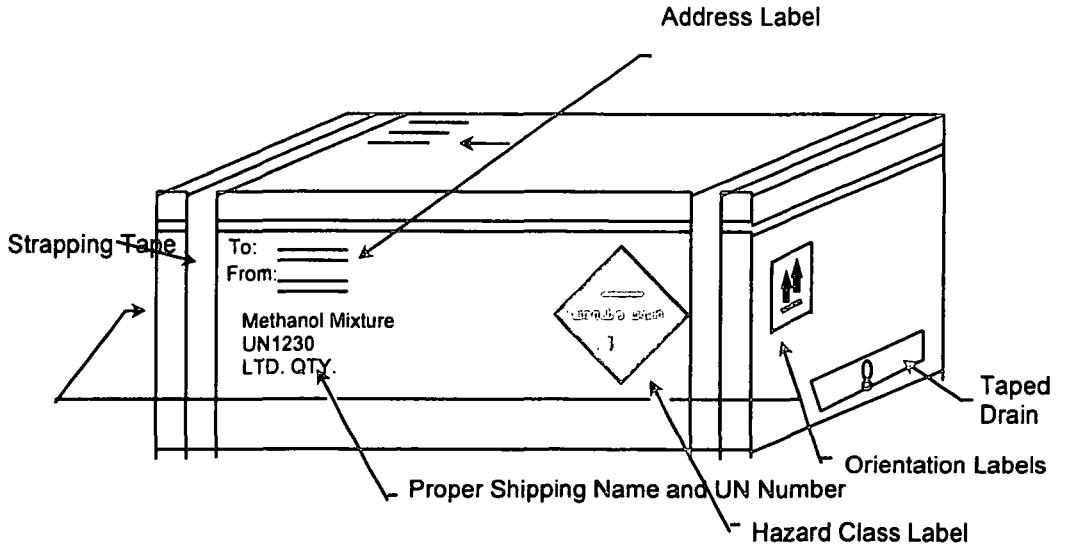
  Methanol Mixture
  UN1230
  LTD. QTY.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Flammable Liquid label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/marking locations is shown in Figure 1.

Note: No marking or labeling can be obscured by strapping or duct tape.
Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.

- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

Figure 1 - Example of Cooler Label/Marking Locations



3.0 Packaging and Shipping Samples Preserved with Sodium Hydroxide

3.1 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Excepted Quantities of Sodium Hydroxide Preservatives

Preservative		*Desired in Final Sample*		*Quantity of Preservative (ml) for Specified Container*				
		pH	Conc.	40 ml	125 ml	250 ml	500 ml	1 L
NaOH	30%	>12	0.08%		.25	0.5	1	2

5 drops = 1 ml

3.2 Responsibility

It is the responsibility of the qualified shipper to determine the amount of preservative in each sample so that accurate determination of quantities can be made.

3.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3:

- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test
- Inner packings may consist of glass or plastic jars no larger than 1 pint
- Survey documentation (if shipping from DOE or radiological sites)
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

3.4 Packaging Samples Preserved with Sodium Hydroxide

Samples containing NaOH as a preservative that exceed the excepted concentration of 0.08 percent (2 ml of a 30 percent NaOH solution per liter) may be shipped as a limited quantity per packing instruction Y819 of the IATA/ICAO Dangerous Goods Regulations.

The following steps are to be followed when packaging limited-quantity samples shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
- At a minimum the label must contain:
  - Project name
  - Project number
  - Date and time of sample collection
  - Sample location
  - Sample identification number
  - Collector's initials
  - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody form)
- This step is optional; wrap each container in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place glass containers inside a polyethylene bottle filled with vermiculite; seal the bottle.
- The total volume of sample in each cooler must not exceed 1 liter.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tieing or taping.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.

- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

Sodium Hydroxide Solution
UN1824
LTD. QTY.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/marking locations is shown in Figure 1.

Note: Samples meeting the exception concentration of 0.08 percent NaOH by weight may be shipped as non-regulated or non-hazardous following the procedure in Section 1.4.

Note: No marking or labeling can be obscured by strapping or duct tape.

Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.

- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

4.0 Packaging and Shipping Samples Preserved with Hydrochloric Acid

4.1 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Excepted Quantities of Hydrochloric Acid Preservatives

Preservative		*Desired In Final Sample*		*Quantity of Preservative (ml) for Specified Container*		
		pH	Conc.	40 ml	125 ml	250 ml
HCl	2N	<1.96	0.04%	.2	.5	1

5 drops = 1 ml

4.2 Responsibility

It is the responsibility of the qualified shipper to:

- Determine the samples undergoing shipment contain no other contaminant that meets the definition of hazardous material as defined by DOT
- Determine the amount of preservative in each sample so that accurate determination of quantities can be made

4.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3.

- Inner packing may consist of glass or plastic jars no larger than 1 pint.
- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test.
- Survey documentation (if shipping from DOE or radiological sites)
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

4.4 Packaging Samples Preserved with Hydrochloric Acid

The following steps are to be followed when packaging limited-quantity sample shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
- At a minimum the label must contain:
  - Project name
  - Project number
  - Date and time of sample collection
  - Sample location
  - Sample identification number
  - Collector's initials
  - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody form)
- Wrap each container (40-ml VOA vials) in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place wrapped containers inside a polyethylene bottle filled with vermiculite; seal the bottle. (No more than 4 VOA vials will fit inside a 500-ml wide-mouth polyethylene bottle.)

- Total volume of sample inside each cooler must not exceed 1 liter.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tieing or taping.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

  Hydrochloric Acid Solution
  UN1789
  LTD. QTY.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/marking locations is shown in Figure 1.

  Note: Samples containing less than the exception concentration of 0.04 percent HCl by weight will be shipped as non-regulated or non-hazardous following the procedure in Section 1.4.

  Note: No marking or labeling can be obscured by strapping or duct tape.

  Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.

- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.

- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

5.0 Packaging and Shipping Samples Preserved with Nitric Acid

5.1 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Excepted Quantities of Nitric Acid Preservatives

Preservative		*Desired In Final Sample*		*Quantity of Preservative (ml) for Specified Container*				
		pH	Conc.	40 ml	125 ml	250 ml	500 ml	1 L
HNO_3	6N	<1.62	0.15%		2	4	5	8

5 drops = 1 ml

5.2 Responsibility

It is the responsibility of the qualified shipper to:

- Determine the samples undergoing shipment contain no other contaminant that meets the definition of hazardous material as defined by DOT
- Determine the amount of preservative in each sample so that accurate determination of quantities can be made

5.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3.

- Inner packings may consist of glass or plastic jars no larger than 100 ml.
- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test.
- Survey documentation (if shipping from DOE or radiological sites)
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

5.4 Packaging Samples Preserved with Nitric Acid

Samples containing HNO_3 as a preservative that exceed the excepted concentration of 0.15 percent HNO_3 will be shipped as a limited quantity per packing instruction Y807 of the IATA/ICAO Dangerous Goods Regulations.

The following steps are to be followed when packaging limited-quantity sample shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
- At a minimum the label must contain:
  - Project name

- Project number
- Date and time of sample collection
- Sample location
- Sample identification number
- Collector's initials
- Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody)

- This step is optional; wrap each container in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place glass containers inside a polyethylene bottle filled with vermiculite; seal the bottle.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tieing or taping.
- The maximum volume of preserved solution in the cooler must not exceed 500 ml.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

Nitric Acid Solution (with less than 20 percent)
UN2031
Ltd. Qty.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/marking locations is shown in Figure 1.

Note: Samples meeting the exception concentration of 0.15 percent HNO_3 by weight will be shipped as non-regulated or non-hazardous following the procedure in Section 1.4.

Note: No marking or labeling can be obscured by strapping or duct tape.

Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.

- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

6.0 Packaging and Shipping Samples Preserved with Sulfuric Acid

6.1 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Excepted Quantities of Sulfuric Acid Preservatives

Preservative		*Desired in Final Sample*		*Quantity of Preservative (ml) for Specified Container*				
		pH	Conc.	40 ml	125 ml	250 ml	500 ml	1 L
H_2SO_4	37N	<1.15	0.35%	.1	.25	0.5	1	2

5 drops = 1 ml

6.2 Responsibility

It is the responsibility of the qualified shipper to:

- Determine the samples undergoing shipment contain no other contaminant that meets the definition of hazardous material as defined by DOT
- Determine the amount of preservative in each sample so that accurate determination of quantities can be made

6.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3.

- Inner packings may consist of glass or plastic jars no larger than 100 ml.
- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test.
- Survey documentation (if shipping from DOE or radiological sites)
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

6.4 Packaging of Samples Preserved with Sulfuric Acid

Samples containing H_2SO_4 as a preservative that exceed the excepted concentration of 0.35 percent will be shipped as a limited quantity per packing instruction Y809 of the IATA/ICAO Dangerous Goods Regulations.

The following steps are to be followed when packaging limited-quantity samples shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
- At a minimum the label must contain:
  - Project name
  - Project number
  - Date and time of sample collection
  - Sample location
  - Sample identification number
  - Collector's initials
  - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody form)
- Wrap each glass container in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place glass containers inside a polyethylene bottle filled with vermiculite; seal the bottle.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tieing or taping.
- The maximum volume of preserved solution in the cooler must not exceed 500 ml.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

Sulfuric Acid Solution
UN2796
LTD. QTY.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/marking locations is shown in Figure 1.

Note: Samples containing less than the exception concentration of 0.35 percent H_2SO_4 by weight will be shipped as non-regulated or non-hazardous in accordance with the procedure described in Section 1.4.

Note: No marking or labeling can be obscured by strapping or duct tape.

Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.

- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

7.0 Packaging and Shipping Limited-Quantity Radioactive Samples

7.1 Containers

The inner packaging containers that may be used for these shipments include:

- Any size sample container

7.2 Description/Responsibilities

- The qualified shipper will determine that the samples undergoing shipment contain no other contaminant that meets the definition of hazardous material as defined by DOT.
- The qualified shipper will ship all samples that meet the Class 7 definition of radioactive materials and meet the activity requirements specified in Table 7 of 49 CFR 173.425, as Radioactive Materials in Limited Quantity. The qualified shipper will verify that all packages and their contents meet the requirements of 49 CFR 173.421, *Limited Quantities of Radioactive Materials.*
- The packaging used for shipping will meet the general requirements for packaging and packages specified in 49 CFR 173.24 and the general design requirements provided in 173.410. These standards state that a package must be capable of withstanding the effects of any acceleration, vibration, or vibration resonance that may arise under normal condition of transport without any deterioration in the effectiveness of the closing devices on the various

receptacles or in the integrity of the package as a whole and without loosening or unintentionally releasing the nuts, bolts, or other securing devices even after repeated use.

- If the shipment is from a DOE facility, radiological screenings will be completed on all samples taken. The qualified shipper will review the results of each screening (alpha, beta, and gamma speciation). Samples will not be shipped offsite until the radiological screening has been performed.
- The total activity for each package will not exceed the relevant limits listed in Table 7 of 49 CFR 173.425. The A_2 value of the material will be calculated based on all radionuclides found during previous investigations (if any) in the area from which the samples are derived. The A_2 values to be used will be the most restrictive of all potential radionuclides as listed in 49 CFR 173.435.
- The radiation level at any point on the external surface of the package bearing the sample(s) will not exceed 0.005 mSv/hour (0.5 mrem/hour). These will be verified by dose and activity monitoring prior to shipment of the package.
- The removable radioactive surface contamination on the external surface of the package will not exceed the limits specified in 49 CFR 173.443(a). CDM will apply the DOE-established free release criteria for removable surface contamination of less than 20 dpm/100 cm^2 (alpha) and 1,000 dpm/100 cm^2 (beta/gamma). It should be noted that these values are more conservative than the DOT requirements for removable surface contamination.
- The qualified shipper will verify that the outside of the inner packaging is marked "Radioactive."
- The qualified shipper will verify that the excepted packages prepared for shipment under the provisions of 49 CFR 173.421 have a notice enclosed, or shown on the outside of the package, that reads, **"This package conforms to the conditions and limitations specified in 49 CFR 173.421 for radioactive material, excepted package-limited quantity of material, UN2910."**

7.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3.

- Survey documentation/radiation screening results (if shipping from DOE or radiological sites)
- Orientation labels
- Excepted quantities label
- Consignor/consignee labels

7.4 Packaging of Limited-Quantity Radioactive Samples

The following steps are to be followed when packaging limited-quantity sample shipments.

- The cooler is to be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
- At a minimum the label must contain:
  - Project name
  - Project number

- Date and time of sample collection
- Sample location
- Sample identification number
- Collector's initials

- This step is optional; wrap each container in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place sufficient amount of vermiculite, or approved packaging material, in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- If required, place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tieing or taping.
- Place a label marked Radioactive on the outside of the sealed bag.
- Enclose a notice that includes the name of the consignor or consignee and the following statement: **"This package conforms to the conditions and limitations specified in 49 CFR 173.421 for radioactive material, excepted package-limited quantity of material, UN2910."**
- Note that both DOT and IATA apply different limits to the quantity in the inside packing and in the outside packing.
- The maximum weight of the package shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- If a cooler is used, wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix package orientation labels on two opposite sides of the cooler/package.
- Affix a completed Excepted Quantities label to the side of the cooler/package.
- Secure any marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of the cooler labeling/marking is shown in Figure 2.

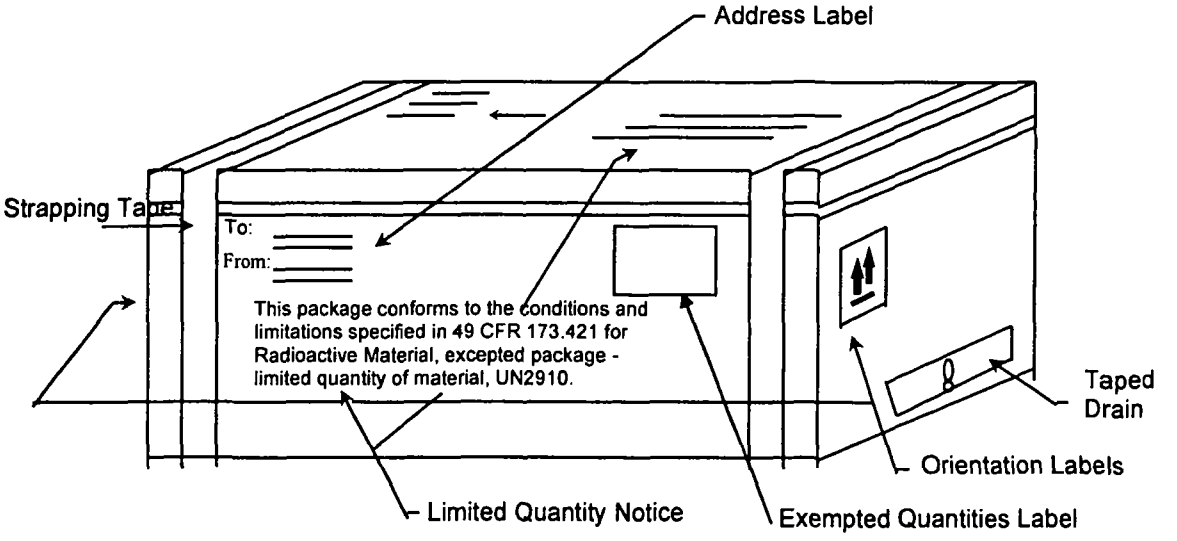
  Note: No marking or labeling can be obscured by strapping or duct tape.

- Complete the Shipment Quality Assurance Checklist (Appendix B).

  Note: Except as provided in 49 CFR 173.426, the package will not contain more than 15 grams of ^{235}U.

  Note: A declaration of dangerous goods is not required.

Figure 2 - Radioactive Material – Limited-Quantity Cooler Marking Example



8.0 References

U.S. Environmental Protection Agency, *Sampler's Guide to the Contract Laboratory Program*, EPA/540/P-90/006, December 1990.

U.S. Environmental Protection Agency, Region IV, *Standard Operating Procedures and Quality Assurance Manual*, February 1991.

U.S. Environmental Protection Agency Rule, 40 CFR 136.

Appendix A

Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity

Sample Packaging

Yes	No	N/A	
☐	☐	☐	The VOA vials are wrapped in bubble wrap and placed inside a zip-type bag.
☐	☐	☐	The VOA vials are placed into a polyethylene bottle, filled with vermiculite, and tightly sealed.
☐	☐	☐	The drain plug is taped inside and outside to ensure control of interior contents.
☐	☐	☐	The samples have been placed inside garbage bags with sufficient bags of ice to preserve samples at 4°C.
☐	☐	☐	The cooler weighs less than the 66-pound limit for limited-quantity shipment.
☐	☐	☐	The garbage bag has been sealed with tape (or tied) to prevent movement during shipment.
☐	☐	☐	The chain-of-custody has been secured to the interior of the cooler lid.
☐	☐	☐	The cooler lid and sides have been taped to ensure a seal.
☐	☐	☐	The custody seals have been placed on both the front and back hinges of the cooler, using waterproof tape.

Air Waybill Completion

Yes	No	N/A	
☐	☐	☐	Section 1 has the shipper's name, company, and address; the account number, date, internal billing reference number; and the telephone number where the shipper can be reached.
☐	☐	☐	Section 2 has the recipient's name and company along with a telephone number where they can be reached.
☐	☐	☐	Section 3 has the **Bill Sender** box checked.
☐	☐	☐	Section 4 has the **Standard Overnight** box checked.
☐	☐	☐	Section 5 has the **Deliver Weekday** box checked.
☐	☐	☐	Section 6 has the number of packages and their weights filled out. Was the total of all packages and their weights figured up and added at the bottom of Section 6?
☐	☐	☐	Under the **Transport Details** box, the **Cargo Aircraft Only** box is obliterated, leaving only the **Passenger and Cargo Aircraft** box.
☐	☐	☐	Under the **Shipment Type**, the **Radioactive** box is obliterated, leaving only the **Non-Radioactive** box.
☐	☐	☐	Under the **Nature and Quantity of Dangerous Goods** box, the **Proper Shipping Name, Class or Division, UN or ID No., Packing Group, Subsidiary Risk, Quantity and Type of Packing, Packing Instructions, and Authorization** have been filled out for the type of chemical being sent.
☐	☐	☐	The **Name, Place and Date, Signature, and Emergency Telephone Number** appears at the bottom of the FedEx Airbill.
☐	☐	☐	The statement "In accordance with IATA/ICAO" appears in the **Additional Handling Information** box.
☐	☐	☐	The **Emergency Contact Information** at the bottom of the FedEx Airbill is truly someone who can respond any time of the day or night.

Proper Shipping Name	*Class or Division*	*UN or ID No.*	*Packing Group*	*Sub Risk*	*Quantity*	*Packing Instruction*	*Authorization*
Hydrochloric Acid Solution	8	UN1789	II		1 plastic box × 0.5 L	Y809	Ltd. Qty.
Nitric Acid Solution (with less than 20%)	8	UN2031	II		1 plastic box × 0.5 L	Y807	Ltd. Qty.
Sodium Hydroxide Solution	8	UN1824	II		1 plastic box × 0.5 L	Y809	Ltd. Qty.
Sulfuric Acid Solution	8	UN2796	II		1 plastic box × 0.5 L	Y809	Ltd. Qty.
Methanol	3	UN1230	II		1 plastic box × 1 L	Y305	Ltd. Qty.

Sample Cooler Labeling

Yes	No	N/A	
❑	❑	❑	The proper shipping name, UN number, and Ltd. Qty. appears on the shipping container.
❑	❑	❑	The corresponding hazard labels are affixed on the shipping container; the labels are not obscured by tape.
❑	❑	❑	The name and address of the shipper and receiver appear on the top and side of the shipping container.
❑	❑	❑	The air waybill is attached to the top of the shipping container.
❑	❑	❑	**Up Arrows** have been attached to opposite sides of the shipping container.
❑	❑	❑	Packaging tape does not obscure markings or labeling.

Appendix B
Shipment Quality Assurance Checklist

Date: _____ Shipper: _____ Destination: _____

Item(s) Description: _____

Radionuclide(s): _____

Radiological Survey Results: surface _____mrem/hr 1 meter _____

Instrument Used: Mfgr: _____ Model: _____

S/N: _____ Cal Date: _____

Limited-Quantity or Instrument and Article

Yes	No		
___	___	1.	Strong tight package (package that will not leak material during conditions normally incidental to transportation).
___	___	2.	Radiation levels at any point on the external surface of package less than or equal to 0.5 mrem/hr.
___	___	3.	Removable surface contamination less than 20 dpm/100 cm^2 (alpha) and 1,000 dpm/100 cm^2 (beta/gamma).
___	___	4.	Outside inner package bears the marking "Radioactive."
___	___	5.	Package contains less than 15 grams of ^{235}U (check yes if ^{235}U not present).
___	___	6.	Notice enclosed in or on the package that includes the consignor or consignee and the statement, **"This package conforms to the conditions and limitations specified in 49 CFR 173.421 for radioactive material, excepted package-limited quantity of material, UN2910."**
___	___	7.	Activity less than that specified in 49 CFR 173.425. Permissible package limit: Package Quantity:
___	___	8.	On all air shipments, the statement **Radioactive Material, excepted package-limited quantity of material** shall be noted on the air waybill.

Qualified Shipper: _____ Signature: _____

Project Specific Modification

SOP No.: 2-2

SOP Title: Guide to Handling Investigation-Derived Waste

Project: Libby Asbestos Remedial Investigation (RI)

Project No.: 3282-137

Client: U.S. Environmental Protection Agency

Project Manager: _____ Date: 5/7/03

Technical Reviewer: _____ Date: 5/7/03

QA Reviewer: _____ Date: 5/12/03

EPA Approval: _____ Date: 5/19/03

Reason for and duration of modification: Site-specific procedures for disposing of Libby amphibole asbestos contaminated IDW are different than CDM Technical SOP 2-2. These modifications are necessary for the entire duration of the project.

All IDW will be handled in accordance with CDM Technical SOP 2-2, Guide to Handling Investigation-Derived Waste, with the following modifications:

Section 5.2, Off Site Disposal - All IDW (not including excess soil volume) will be collected in transparent garbage bags and marked "IDW" with an indelible marker. These bags will be deposited into the asbestos contaminated waste stream for deposal at the mine.

Guide To Handling Investigation-Derived Waste

SOP: 2-2
Revision: 4
Date: March 1, 2004

Prepared: Tim Eggert
Technical Review: Sharon Budney
QA Review: Jeniffer Oxford
Approved: Michael C. Mally 2/24/04
Signature/Date
Issued: 2/10/04
Signature/Date

1.0 Objective

This standard operating procedure (SOP) presents guidance for the management of investigation-derived waste (IDW). The primary objectives for managing IDW during field activities include:

- Leaving the site in no worse condition than existed prior to field activities
- Remove wastes that pose an immediate threat to human health or the environment
- Proper handling of onsite wastes that do not require offsite disposal or extended above-ground containerization
- Complying with federal, state, and facility applicable or relevant and appropriate requirements (ARARs)
- Careful planning and coordination of IDW management options
- Minimizing the quantity of IDW

2.0 Background

2.1 Definitions

Hazardous Waste – Discarded material that is regulated listed waste, or waste that exhibits ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR 261.3 or state regulations.

Investigation-Derived Wastes (IDWs) - Discarded materials resulting from field activities such as sampling, surveying, drilling, excavations, and decontamination processes that, in present form, possess no inherent value or additional usefulness without treatment. Wastes may be solid, liquid, or gaseous, or multiphase materials that may be classified as hazardous or non-hazardous.

Mixed-Waste - Any material that has been classified as hazardous and radioactive.

Radioactive Wastes – Discarded materials that are contaminated with radioactive constituents with specific activities in concentrations greater than the latest regulatory criteria (i.e., 10 CFR 20).

Treatment, Storage, and Disposal Facility (TSDF) - Permitted facilities that accept hazardous waste shipments for further treatment, storage, and/or disposal. These facilities must be permitted by the U.S. Environmental Protection Agency (EPA) and appropriate state agencies.

2.2 Discussion

Field investigation activities result in the generation of waste materials that may be characterized as hazardous or radioactive waste. IDWs may include drilling muds, cuttings, and purge water from test pit and well installation; purge water, soil, and other materials from collection of samples; residues from testing of treatment technologies and pump and treat systems; personal protective equipment (PPE); solutions (aqueous or otherwise) used to decontaminate non-disposable protective clothing and

equipment; and other wastes or supplies used in sampling and testing potentially hazardous or radiologically contaminated material.

Note: The client's representatives may not be aware of all potential contaminants. The management of IDW must comply with applicable regulatory requirements.

3.0 Responsibilities

Site Manager - The site manager is responsible for ensuring that all IDW procedures are conducted in accordance with this SOP. The site manager is also responsible for ensuring that handling of IDW is in accordance with site-specific requirements.

Project Manager - The project manager is responsible for identifying site-specific requirements for the disposal of IDW in accordance with federal, state, and/or facility requirements.

Field Crew Members - Field crew members are responsible for implementing this SOP and communicating any unusual or unplanned condition to the project manager's attention.

4.0 Required Equipment

Equipment required for IDW containment will vary according to site-specific/client requirements. Management decisions concerning the necessary equipment required should consider: containment method, sampling, labeling, maneuvering, and storage (if applicable). Equipment must be onsite and inspected before commencing work.

4.1 IDW Containment Devices

The appropriate containment device (drums, tanks, etc.) will depend on site- or client-specific requirements and the ultimate disposition of the IDW. Typical IDW containment devices can include:

- Plastic sheeting (polyethylene) with a minimum thickness of 20 millimeters
- Department of Transportation (DOT) approved steel containers
- Bulk storage tanks comprised of polyethylene or steel

Containment of IDW should be segregated by waste type (i.e., solid or liquid, corrosive or flammable, etc.) and source location. Volume of the appropriate containment device should be site-specific.

4.2 IDW Container Labeling

A "Waste Container" or "IDW Container" label or indelible marking should be applied to each container. Labeling or marking requirements for onsite IDW not expected to be transported offsite are:

- Labels and markings that contain the following information: project name, generation date, location of waste origin, container identification number, sample number (if applicable), and contents (drill cuttings, purge water, PPE, etc.).
- Each label or marking will be applied to the upper one-third of the container at least twice, on opposite sides.
- Containers that are 5 gallons or less may only require one label or set of markings.
- Labels or markings will be positioned on a smooth part of the container. The label must not be affixed across container bungs, seams, ridges, or dents.

- Labels must be constructed of a weather-resistive material with markings made with a permanent marker or paint pen and capable of enduring the expected weather conditions. If markings are used, the color must be easily distinguishable from the drum color.
- Labels will be secured in a manner to ensure the label remains affixed to the container.

Labeling or marking requirements for IDW expected to be transported offsite must be in accordance with the requirements of 49 CFR 172.

4.3 IDW Container Movement

Staging areas for IDW containers should be predetermined and in accordance with site-specific and/or client requirements. Arrangements should be made prior to field mobilization as to the methods and personnel required to safely transport IDW containers to the staging area. Transportation offsite onto a public roadway is prohibited unless 49 CFR 172 requirements are met.

4.4 IDW Container Storage

Containerized IDW should be staged pending chemical analysis or further onsite treatment. Staging areas and bulk storage procedures are to be determined according to site-specific requirements. Containers are to be stored in such a fashion that the labels can be easily read. A secondary/spill container must be provided as appropriate.

5.0 Procedures

The three general options for managing IDW are (1) collection and onsite disposal, (2) collection for offsite disposal, and (3) collection and interim management. Attachment 1 summarizes media-specific information on generation processes and management options. The option selected should take into account the following factors:

- Type (soil, sludge, liquid, debris), quantity, and source of IDW
- Risk posed by managing the IDW onsite
- Compliance with regulatory requirements
- IDW minimization and consistency with the IDW remedy and the site remedy

In all cases the client should approve the plans for IDW. Formal plans for the management of IDW must be prepared as part of a work plan or separate document.

5.1 Onsite Disposal

5.1.1 Soil/Sludge/Sediment

The options for handling soil/sludge/sediment IDW are as follows:

1. Return to boring, pit, or source immediately after generation as long as returning the media to these areas will not increase site risks (e.g., the contaminated soil will not be replaced at a greater depth than where it was originally so that it will not contaminate "clean" areas).

2. Spread around boring, pit, or source within the area of contamination (AOC) as long as returning the media to these areas will not increase site risks (e.g., direct contact with surficial contamination).

3. Consolidate in a pit within the AOC as long as returning the media to these areas will not increase site risks (e.g., the contaminated soil will not be replaced at a greater depth than where it was originally so that it will not contaminate "clean" areas).

4. Send to onsite TSDF - may require analytical analysis prior to treatment/disposal.

Note: These options may require client and/or regulatory approval.

5.1.2 Aqueous Liquids
The options for handling aqueous liquid IDW are as follows:

1. Discharge to surface water, only when IDW is not contaminated.

2. Discharge to ground surface close to the well, only if soil contaminants will not be mobilized in the process and the action will not contaminate clean areas. If IDW from the sampling of background upgradient wells is not a community concern or associated with soil contamination, this presumably uncontaminated IDW may be released on the ground around the well.

3. Discharge to sanitary sewer.

4. Send to onsite TSDF - may require analysis prior to treatment/disposal.

Note: These options may require analytical results to obtain client and/or regulatory approval.

5.1.3 Disposable PPE
The options for handling disposable PPE are as follows:

1. Double-bag contents in non-transparent trash bags and place in onsite industrial dumpster, only if PPE is not contaminated.

2. Containerize, label, and send to onsite TSDF - may require analysis prior to treatment/disposal.

5.2 Offsite Disposal

Before sending to an offsite TSDF, analysis may be required. Also, manifests are required. Arrangements must be made with the client responsible for the site; it is CDM's policy not to sign manifests. The TSDF and transporter must be permitted for the respective wastes.

5.2.1 Soil/Sludge/Sediment
When the final site remedy requires offsite treatment and disposal, the IDW may be stored (e.g., drummed, covered in a waste pile) or returned to its source until final disposal. The management option selected should take into account the potential for increased risks, applicable regulations, and other relevant site-specific factors (e.g., weather, storage space, and public concern/perceptions).

5.2.2 Aqueous Liquids
When the final site remedy requires offsite treatment and disposal, the IDW may be stored (e.g., mobile tanks or drums) until final disposal. The management option selected should take into account the

potential for increased risks, applicable regulations, and other relevant site-specific factors (e.g., weather, storage space, and public concern/perceptions).

5.2.3 Disposable PPE
When the final site remedy requires offsite treatment disposal, the IDW may be containerized and stored. The management option selected should take into account potential for increased risks, applicable regulations, and other relevant site-specific factors (e.g., weather, storage space, and public concern/perceptions).

5.3 Interim Measures
All interim measures must be approved by the client and regulatory agencies.

1. Storing IDW onsite until the final action may be practical in the following situations:

   A. Returning wastes (especially sludges and soils) to their onsite source area would require re-excavation for disposal in the final remediation alternative.

   B. Interim storage in containers may be necessary to provide adequate protection to human health and the environment.

   C. Offsite disposal options may trigger land disposal regulations under the Resource Conservation and Recovery Act (RCRA). Storing IDW until the final disposal of all wastes from the site will eliminate the need to address this issue more than once.

   D. Interim storage may be necessary to provide time for sampling and analysis.

2. Segregate and containerize all waste for future treatment and/or disposal.

   A. Containment options for soil/sludge/sediment may include drums or covered waste piles in AOC.

   B. Containment options for aqueous liquids may include mobile tanks or drums.

   C. Containment options for PPE may include drums or roll-off boxes.

6.0 Restrictions/Limitations
Site Managers Should Determine the Most Appropriate Disposal Option for Aqueous Liquids on a Site-Specific Basis. Parameters to consider, especially when determining the level of protection, include the volume of IDW, the contaminants present in the groundwater, the presence of contaminants in the soil at the site, whether the groundwater or surface water is a drinking water supply, and whether the groundwater plume is contained or moving. Special disposal/handling may be needed for drilling fluids because they may contain significant solid components.

Disposable sampling materials, disposable PPE, decontamination fluids, etc. will always be managed on a site-specific basis. **Under No Circumstances Should These Types of Materials Be Brought Back to the Office or Warehouse.**

7.0 References

Environmental Resource Center. 1992. *Hazardous Waste Management Compliance Handbook,* Van Nostrand Reinhold.

Institute of Hazardous Materials Management. 1992. *Handbook on Hazardous Materials Management,* 4th Ed.

U. S. Environmental Protection Agency. 1987. *A Compendium of Superfund Field Operations Methods,* EPA/540/P-87/001.1.

U. S. Environmental Protection Agency. August 1990. *Low-Level Mixed Waste: A RCRA Perspective for NRC Licensees,* EPA/530-SW-90-057.

U. S. Environmental Protection Agency. May 1991. *Management of Investigation-Derived Wastes During Site Inspections,* EPA/540/G-91/009.

U. S. Environmental Protection Agency. January 1992. *Guide to Management of Investigation-Derived Wastes,* 9345.3-03FS.

U. S. Environmental Protection Agency, Region IV. May 1996 and 1997. *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual,* revisions.

Attachment 1
IDW Management Options

Type of IDW	*Generation Processes*	*Management Options*
Soil	■ Well/Test pit installations ■ Borehole drilling ■ Soil sampling	**Onsite Disposal** ■ Return to boring, pit, or source immediately after generation ■ Spread around boring, pit, or source within the AOC ■ Consolidate in a pit (within the AOC) ■ Send to onsite TSDF **Offsite Disposal** ■ Client to send to offsite TSDF **Interim Management** ■ Store for future treatment and/or disposal
Sludge/Sediment	■ Sludge pit/sediment sampling	**Onsite Disposal** ■ Return to boring, pit, or source immediately after generation ■ Send to onsite TSDF **Offsite Disposal** ■ Client to send to offsite TSDF **Interim Management** ■ Store for future treatment and/or disposal
Aqueous Liquids (groundwater, surface water, drilling fluids, wastewaters)	■ Well installation/development ■ Well purging during sampling ■ Groundwater discharge during pump tests ■ Surface water sampling ■ Wastewater sampling	**Onsite Disposal** ■ Pour onto ground close to well (nonhazardous waste) ■ Discharge to sewer ■ Send to onsite TSDF **Offsite Disposal** ■ Client to send to offsite commercial treatment unit ■ Client to send to publicly owned treatment works (POTW) **Interim Management** ■ Store for future treatment and/or disposal
Decontamination Fluids	■ Decontamination of PPE and equipment	**Onsite Disposal** ■ Send to onsite TSDF ■ Evaporate (for small amounts of low contamination organic fluids) ■ Discharge to ground surface **Offsite Disposal** ■ Client to send to offsite TSDF ■ Discharge to sewer **Interim Management** ■ Store for future treatment and/or disposal
Disposable PPE and Sampling Equipment	■ Sampling procedures or other onsite activities	**Onsite Disposal** ■ Place in onsite industrial dumpster ■ Send to onsite TSDF **Offsite Disposal** ■ Client to send to offsite TSDF **Interim Management** ■ Store for future treatment and/or disposal

Adapted from U.S. Environmental Protection Agency, Guide to Management of Investigation-Derived Wastes, 9345-03FS, January 1992.

Project-Specific Modification

SOP No.: 4-1

SOP Title: Field Logbook Content and Control

Project: Libby Asbestos Remedial Investigation (RI)

Project No.: 3282-137

Client: U.S. Environmental Protection Agency

Project Manager: _____ Date: 5/7/03

Technical Reviewer: _____ Date: 5/7/03

QA Reviewer: _____ Date: 5/12/03

EPA Approval: _____ Date: 5/19/03

Reason for and duration of modification: Site-specific procedures field logbook completions are different than CDM Technical SOP 4-1. These modifications are necessary for the entire duration of the project.

All content and control of will logbooks will be done accordance with CDM Technical SOP 4-1, Field Logbook Content and Control, with the following modifications:

Section 5.2, Operation – A new page will be completed for each property where information is collected for RI activities. The header information will include the address, the name of the property owner, and the building identification number of structures on the property.

When following the line-out and signature procedures to close a logbook page, the author must also print their name under the signature.

Libby Asbestos Project
Logbook Requirements
Updated March 2007

Header Information
- Name of contract/project: Volpe/Libby Asbestos Project
- Address of property
- Property owner's name
- Logbook number

Individual Pages
- Date and time (time always in military units)
- Author (please print your name)
- Personnel onsite, description of activities being performed, and title(s) of governing documents

  Examples:
  - John Doe (CDM Oversight) and Jack Black (ER Foreman) on site inspecting ground floor containment in accordance with the RAWP (11/03)
  - John Doe (CDM Air Tech) setting up kneewall clearance samples in accordance with the RAWP (11/03)
- Weather conditions
- Level of personal protection being used
- Equipment being used (e.g., Horiba U22 water quality meter; QuickTake 30 air sampling pump)
- Required calibration information

Other Requirements
- For corrections, line out once, initial, and date the change
- Define less commonly used acronyms/abbreviations
- Do not write over the page number in the logbook
- Describe any **deviations to procedures or processes,** including names of personnel directing the change and implications of the change
- Note periods of down-time, delays, or other problems
- Keep the Table of Contents up-to-date
- Once completing the logbook, make sure the table of contents is complete and unused pages are lined out before turning in to admin staff

For your reference, CDM SOP 4-1 Revision 5 is attached.

Field Logbook Content and Control

Prepared: Del Baird

Technical Review: Sharon Budney

QA Review: Douglas J. Updike

Approved: Michael C. Mally 2/24/04
Signature/Date

Issued: 3/8/04
Signature/Date

1.0 Objective

The objective of this standard operating procedure (SOP) is to set CDM Federal (CDM) criteria for content entry and form of field logbooks. Field logbooks are an essential tool to document field activities for historical and legal purposes.

2.0 Background

2.1 Definitions

Biota - The flora and fauna of a region.

Magnetic Declination Corrections - Compass adjustments to correct for the angle between magnetic north and geographical meridians.

2.2 Discussion

Information recorded in field logbooks includes field team names, observations, data, calculations, date/time, weather, and description of the data collection activity, methods, instruments, and results. Additionally, the logbook may contain deviations from plans and descriptions of wastes, biota, geologic material, and site features including sketches, maps, or drawings as appropriate.

3.0 Responsibilities

Field Team Leader (FTL) - The FTL is responsible for ensuring that the format and content of data entries are in accordance with this procedure.

Site Personnel - All CDM employees who make entries in field logbooks during onsite activities are required to read this procedure prior to engaging in this activity. The FTL will assign field logbooks to site personnel who will be responsible for their care and maintenance. Site personnel will return field logbooks to the records file at the end of the assignment.

4.0 Required Equipment

- Site-specific plans
- Field notebook
- Indelible black or blue ink pen
- Ruler or similar scale

5.0 Procedures

5.1 Preparation

In addition to this SOP, site personnel responsible for maintaining logbooks must be familiar with all procedures applicable to the field activity being performed. These procedures should be consulted as necessary to obtain specific information about equipment and supplies, health and safety, sample collection, packaging, decontamination, and documentation. These procedures should be located at the field office.

Field logbooks shall be bound with lined, consecutively numbered pages. All pages must be numbered prior to initial use of the logbook. Prior to use in the field, each logbook will be marked with a specific document control number issued by the document control administrator, if required by the contract quality implementation plan (QIP). Not all contracts require document control numbers. The following information shall be recorded on the cover of the logbook:

- Field logbook document control number.
- Activity (if the logbook is to be activity-specific) and location.
- Name of CDM contact and phone number(s).
- Start date.
- In specific cases, special logbooks may be required (e.g., waterproof paper for stormwater monitoring).

The first few (approximately five) pages of the logbook will be reserved for a table of contents (TOC). Mark the first page with the heading and enter the following:

Table of Contents

Date/Description	Page
(Start Date)/Reserved for TOC	1-5

The remaining pages of the table of contents will be designated as such with "TOC" written on the top center of each page.

5.2 Operation

Requirements that must be followed when using a logbook:

- Record work, observations, quantities of materials, calculations, drawings, and related information directly in the logbook. If data collection forms are specified by an activity-specific plan, this information need not be duplicated in the logbook. However, any forms used to record site information must be referenced in the logbook.
- Do not start a new page until the previous one is full or has been marked with a single diagonal line so that additional entries cannot be made. Use both sides of each page.
- Do not erase or blot out any entry at any time. Indicate any deletion by a single line through the material to be deleted. Initial and date each deletion. Take care to not obliterate what was written previously.
- Do not remove any pages from the book.

Field Logbook Content and Control

Specific requirements for field logbook entries include:

- Initial and date each page.
- Sign and date the final page of entries for each day.
- Initial and date all changes.
- Multiple authors must sign out the logbook by inserting the following:
  Above notes authored by:
  - (Sign name)
  - (Print name)
  - (Date)
- A new author must sign and print his/her name before additional entries are made.
- Draw a diagonal line through the remainder of the final page at the end of the day.
- Record the following information on a daily basis:
  - Date and time
  - Name of individual making entry
  - Names of field team and other persons onsite
  - Description of activity being conducted including station or location (i.e., well, boring, sampling location number) if appropriate
  - Weather conditions (i.e., temperature, cloud cover, precipitation, wind direction, and speed) and other pertinent data
  - Level of personal protection to be used
  - Serial numbers of instruments
  - Required calibration information
  - Serial/tracking numbers on documentation (e.g., carrier air bills)

Entries into the field logbook shall be preceded with the time (written in military units) of the observation. The time should be recorded frequently and at the point of events or measurements that are critical to the activity being logged. All measurements made and samples collected must be recorded unless they are documented by automatic methods (e.g., data logger) or on a separate form required by an operating procedure. In these cases, the logbook must reference the automatic data record or form.

At each station where a sample is collected or an observation or measurement made, a detailed description of the location of the station is required. Use a compass (include a reference to magnetic declination corrections), scale, or nearby survey markers, as appropriate. A sketch of station location may be warranted. All maps or sketches made in the logbook should have descriptions of the features shown and a direction indicator. It is preferred that maps and sketches be oriented so that north is toward the top of the page. Maps, sketches, figures, or data that will not fit on a logbook page should be referenced and attached to the logbook to prevent separation.

Other events and observations that should be recorded include:

- Changes in weather that impact field activities.
- Deviations from procedures outlined in any governing documents. Also record the reason for any noted deviation.
- Problems, downtime, or delays.
- Upgrade or downgrade of personal protection equipment.

5.3 Post-Operation

To guard against loss of data due to damage or disappearance of logbooks, completed pages shall be periodically photocopied (weekly, at a minimum) and forwarded to the field or project office. Other field records shall be photocopied and submitted regularly and as promptly as possible to the office. When possible, electronic media such as disks and tapes should be copied and forwarded to the project office.

At the conclusion of each activity or phase of site work, the individual responsible for the logbook will ensure that all entries have been appropriately signed and dated, and that corrections were made properly (single lines drawn through incorrect information, then initialed and dated). The completed logbook shall be submitted to the records file.

6.0 Restrictions/Limitations

Field logbooks constitute the official record of onsite technical work, investigations, and data collection activities. Their use, control, and ownership are restricted to activities pertaining to specific field operations carried out by CDM personnel and their subcontractors. They are documents that may be used in court to indicate dates, personnel, procedures, and techniques employed during site activities. Entries made in these logbooks should be factual, clear, precise, and non-subjective. Field logbooks, and entries within, are not to be used for personal use.

7.0 References

Sandia National Laboratories, *Procedure for Preparing Sampling and Analysis Plan, Site-Specific Sampling Plan, and Field Operating Procedures*, QA-02-03, Albuquerque Environmental Program Department 3220, Albuquerque, New Mexico, 1991.

Sandia National Laboratories, Division 7723, *Field Operation Procedure for Field Logbook Content and Control, Environmental Restoration Department*, Albuquerque, New Mexico, 1992.

Project-Specific Modification

SOP No.: 4-2

SOP Title: Photographic Documentation of Field Activities

Project: Libby Asbestos Remedial Investigation (RI)

Project No.: 3282-137

Client: U.S. Environmental Protection Agency

Project Manager: _____ Date: 5/8/03

Technical Reviewer: _____ Date: 5/7/03

QA Reviewer: _____ Date: 5/12/03

EPA Approval: _____ Date: 5/19/03

Reason for and duration of modification: Site-specific procedures for photographs taken by digital cameras are different than the current SOP.

All photographs will be recorded in accordance with CDM Technical SOP 4-2, Photographic Documentation of Field Activities, with the following modifications:

Section 5.2.2, General Guidelines for Still Photography - A slate is not required for each new roll of film. The information for the slate will be recorded in the field logbook. The numbers assigned by the digital camera will be used instead of the photographer assigning the number. The caption information will either be on the back of the photograph or the photograph will be numbered or labeled and the caption information listed next to the number or label in the photograph log. On the digital photos, a caption will be included in the picture stating property address/location, date, and name of feature. All team members, as stated in the logbook, will be photographers and witnesses at the property. Slates are not required for close-up photographs. Instead the required information can be listed in the logbook or photograph log. A color strip is not required for close-up or feature photographs.

Section 5.2.4, Photographic Documentation - The name of the laboratory, time and date of drop-off, and receipt of film is not required to be recorded for this project.

Project-Specific Modification

Section 5.3.2, Archive Procedures - Digital photographs will be archived on compact discs. These discs will be assigned a document control dumber written on the disc case as well as well as the disc.

Photographic Documentation of Field Activities

Prepared: David O. Johnson
Technical Review: Jo Nell Mullins
QA Review: Laura Splichal
Approved: Michael C. Mally 2/24/04
Signature/Date
Issued: 2/18/04
Signature/Date

1.0 Objective

The purpose of this standard operating procedure (SOP) is to provide standard guidelines and methods for photographic documentation, which include still and digital photography and videotape recordings of field activities and site features (geologic formations, core sections, lithologic samples, water samples, general site layout, etc.). This document shall provide guidelines designed for use by a professional or amateur photographer. This SOP is intended for circumstances when formal photographic documentation is required. Based on project requirements, it may not be applicable for all photographic activities.

2.0 Background

2.1 Definitions

Photographer - A photographer is the camera operator (professional or amateur) of still photography, including digital photography, or videotape recording whose primary function with regard to this SOP is to produce documentary or data-oriented visual media.

Identifier Component - Identifier components are visual components used within a photograph such as visual slates, reference markers, and pointers.

Standard Reference Marker - A standard reference marker is a reference marker that is used to indicate a feature size in the photograph and is a standard length of measure, such as a ruler, meter stick, etc. In limited instances, if a ruled marker is not available or its use is not feasible, it can be a common object of known size placed within the visual field and used for scale.

Slates - Slates are blank white index cards or paper used to present information pertaining to the subject/procedure being photographed. Letters and numbers on the slate will be bold and written with black, indelible marking pens.

Arrows and Pointers - Arrows and pointers are markers/pointers used to indicate and/or draw attention to a special feature within the photograph.

Contrasting Backgrounds - Contrasting backgrounds are backdrops used to lay soil samples, cores, or other objects on for clearer viewing and to delineate features.

Data Recording Camera Back - A data recording camera back is a camera attachment or built-in feature that will record, at the very least, frame numbers and dates directly on the film.

2.2 Discussion

Photographs and videotape recordings made during field investigations are used as an aid in documenting and describing site features, sample collection activities, equipment used, and possible

lithologic interpretation. This SOP is designed to illustrate the format and desired placement of identifier components, such as visual slates, standard reference markers, and pointers. These items shall become an integral part of the "visual media" that, for the purpose of this document, shall encompass still photographs, digital photographs, and videotape recordings (or video footage). The use of a photographic logbook and standardized entry procedures are also outlined. These procedures and guidelines will minimize potential ambiguities that may arise when viewing the visual media and ensure the representative nature of the photographic documentation.

2.3 Associated Procedures

- CDM Federal SOP 4-1, Field Logbook Content and Control

3.0 Responsibilities

Field Team Leader (FTL) - The FTL is responsible for ensuring that the format and content of photographic documentation are in accordance with this procedure. The FTL is responsible for directing the photographer to specific situations, site features, or operations that the photographer will be responsible for documenting.

Photographer - The photographer shall seek direction from the FTL and regularly discuss the visual documentation requirements and schedule. The photographer is responsible for maintaining a logbook per Sections 5.1, 5.2.4, and 5.3.1 of this SOP.

4.0 Required Equipment

The following is a general list of equipment that may be used:

- 35mm camera or disposable single use camera (35mm or panoramic use)
- Digital camera
- Extra batteries for 35mm camera
- Video camera
- Logbook
- Indelible black or blue ink pen
- Standard reference markers
- Slates
- Arrows or pointers
- Contrasting backgrounds
- Medium speed, or multi purpose fine-grain, color, 35 mm negative film or slide film (project dependent)
- Data recording camera back (if available)
- Storage medium for digital camera

5.0 Procedures

5.1 Documentation

A commercially available, bound logbook will be used to log and document photographic activities. Review the CDM Federal SOP 4-1, Field Logbook Content and Control and prepare all supplies needed for logbook entries.

Note: A separate photographic logbook is not required. A portion of the field logbook may be designated as the photographic log and documentation section.

5.1.1 Field - Health and Safety Considerations

There are no hazards that an individual will be exposed to specific to photographic documentation. However, site-specific hazards may arise depending on location or operation. Personal protective equipment used in this operation will be site-specific and dictated through requirements set by the site safety officer, site health and safety plan, and/or prescribed by the CDM Federal Corporate Health and Safety Program. The photographer should contact the site safety officer for health and safety orientation prior to commencing field activities. The site health and safety plan must be read prior to entry to the site, and all individuals must sign the appropriate acknowledgement that this has been done.

The photographer should be aware of any potential physical hazards while photographing the subject (e.g., traffic, low overhead hazard, edge of excavation).

5.2 Operation

5.2.1 General Photographic Activities in the Field

The following sections provide general guidelines that should be followed to visually document field activities and site features using still/digital cameras and video equipment. Listed below are general suggestions that the photographer should consider when performing activities under this SOP:

- The photographer should be prepared to make a variety of shots, from close-up to wide-angle. Many shots will be repetitive in nature or format especially close-up site feature photographs. Consideration should therefore be given to designing a system or technique that will provide a reliable repetition of performance.
- All still film photographs should be made using a medium speed, or multi purpose fine-grain, color negative film in the 35 mm format unless otherwise directed by the FTL.
- It is suggested that Kodak brand "Ektapress Gold Deluxe" film or equivalent be used as the standard film for the still photography requirements of the field activities. This film is stable at room temperature after exposure and will better survive the time lag between exposure and processing. It is suggested that film speed ASA 100 should be used for outdoor photographs in bright sunlight, ASA 200 film should be used in cloudy conditions, and ASA 400 film should be used indoors or for very low-light outdoor photographs.
- No preference of videotape brand or digital storage medium is specified and is left to the discretion of the photographer.
- The lighting for sample and feature photography should be oriented toward a flat condition with little or no shadow. If the ambient lighting conditions are inadequate, the photographer should be prepared to augment the light (perhaps with reflectors or electronic flash) to maintain the desired visual effect.
- Digital cameras have multiple photographic quality settings. A camera that obtains a higher resolution (quality) has a higher number of pixels and will store a fewer number of photographs per digital storage medium.

5.2.2 General Guidelines for Still Photography

Slate Information

When directed by the FTL, each new roll of film or digital storage medium shall contain on the first usable frame (for film) a slate with consecutively assigned control numbers (a consecutive, unique number that is assigned by the photographer as in sample numbers).

Caption Information
All still photographs will have a full caption permanently attached to the back or permanently attached to a photo log sheet. The caption should contain the following information (digital photographs should have a caption added after the photographs are downloaded):

- Film roll control number (if required) and photograph sequence number
- Date and time
- Description of activity/item shown (e.g., name of facility/site, specific project name, project no.)
- Direction (if applicable)
- Photographer

When directed by the FTL, a standard reference marker should be used in all documentary visual media. While the standard reference marker will be predominantly used in close-up feature documentation, inclusion in all scenes should be considered.

Digital media should be downloaded at least once each day.

Close-Up and Feature Photography
When directed by the FTL, close-up photographs should include a standard reference marker of appropriate size as an indication of the feature size and contain a slate marked with the site name and any identifying label, such as a well number or core depth, that clearly communicates to the viewer the specific feature being photographed.

Feature samples, core pieces, and other lithologic media should be photographed as soon as possible after they have been removed from their in situ locations. This enables a more accurate record of their initial condition and color. When directed by the FTL, include a standard reference color strip (color chart such as Munsell Soil Color Chart or that available from Eastman Kodak Co.) within the scene. This is to be included for the benefit of the viewer of the photographic document and serves as a reference aid to the viewer for formal lithologic observations and interpretations.

Site Photography
Site photography, in general, will consist predominantly of medium and wide-angle shots. A standard reference marker should be placed adjacent to the feature or, when this is not possible, within the same focal plane.

While it is encouraged that a standard reference marker and caption/slate be included in the scene, it is understood that situations will arise that preclude their inclusion within the scene. This will be especially true of wide-angle shots. In such a case, the film/tape control number shall be entered in the photographic logbook along with the frame number and all other information pertinent to the scene.

Panoramic
In situations where a wide-angle lens does not provide sufficient subject detail, a single-use disposable panoramic camera is recommended. If this type of camera is not available, a panoramic series of two or three photos would be appropriate. Panoramas can provide greater detail while covering a wide subject, such as an overall shot of a site.

To shoot a panoramic series using a standard 35 mm or digital camera, the following procedure is recommended.

- Use a stable surface or tripod to support the camera
- Allow a 20 to 30 percent overlap while maintaining a uniform horizon
- Complete two to three photos per series

5.2.3 General Photographic Documentation Using Video Cameras
As a reminder, it is not within the scope of this document to set appropriate guidelines for presentation or "show" videotape recording. The following guidelines are set for documentary videotape recordings only and should be implemented at the discretion of the FTL.

Documentary videotape recordings of field activities may include an audio slate for all scenes. At the beginning of each video session, an announcer will recite the following information: date, time (in military units), photographer, site ID number, and site location. This oral account may include any additional information clarifying the subject matter being recorded.

A standard reference marker may be used when taking close-up shots of site features with a video camera. The scene may also include a caption/slate. It should be placed adjacent and parallel to the feature being photographed.

It is recommended that a standard reference marker and caption/slate be included in all scenes. The caption information is vital to the value of the documentary visual media and should be included. If it is not included within the scene, it should be placed before the scene.

Original videotape recordings will not be edited. This will maintain the integrity of the information contained on the videotape. If editing is desired, a working copy of the original videotape recording can be made.

A label should be placed on the videotape with the appropriate identifying information (i.e., project name, project number, date, location, etc.).

5.2.4 Photographic Documentation
Photographic activities must be documented in a photographic logbook or in a section of the field logbook. The photographer will be responsible for making proper entries.

In addition to following the technical standards for logbook entry as referenced in CDM Federal SOP 4-1, the following information should be maintained in the appropriate logbook:

- Photographer name.
- If required, an entry shall be made for each new roll/tape control number assigned.
- Sequential tracking number for each photograph taken (for digital cameras, the camera-generated number may be used).
- Date and time (military time).
- Location.
- A description of the activity/item photographed.

- If needed, a description of the general setup, including approximate distance between the camera and the subject, may be recorded in the logbook.
- Record as much other information as possible to assist in the identification of the photographic document.

5.3 Post Operation

All film will be sent for development and printing to a photographic laboratory (to be determined by the photographer). The photographer will be responsible for arranging transport of the film from the field to the photographic laboratory. The photographer shall also be responsible for arranging delivery of the negatives and photographs, digital storage medium, or videotape to the project management representative.

5.3.1 Documentation

At the end of each day's photographic session, the photographer(s) will ensure that the appropriate logbook has been completely filled out and maintained as outlined in CDM Federal SOP 4-1.

5.3.2 Archive Procedures

1. Photographs and the associated set of uncut negatives, digital media, and original unedited documentary videotape recordings will be submitted to the project files and handled according to contract records requirements. The FTL will ensure their proper distribution.

2. Completed pages of the appropriate logbook will be copied weekly and submitted to the project files.

6.0 Restrictions/Limitations

This document is designed to provide a set of guidelines for the field amateur or professional photographer to ensure that an effective and standardized program of visual documentation is maintained.

It is not within the scope of this document to provide instruction in photographic procedures, nor is it within the scope of this document to set guidelines for presentation or "show" photography.

The procedures outlined herein are general by nature. The FTL is responsible for specific operational activity or procedure. Questions concerning specific procedures or requirements should be directed to the FTL.

Note: Some sites do not permit photographic documentation. Check with the site contact for any restrictions.

7.0 References

U.S. Army Corps of Engineers, *Requirements for the Preparation of Sampling and Analysis Plans, EM 200-1-3*, February 2001, Appendix F.

U.S. Environmental Protection Agency, Region IV, *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*, Athens, Georgia, November 2001.

U.S. Environmental Protection Agency, National Enforcement Investigations Center, *Multi-Media Investigation Manual*, EPA-330/9-89-003-R, Revised March 1992, p. 85.

Project-Specific Modification

SOP No.: 4-5

SOP Title: Field Equipment Decontamination at Nonradioactive Sites

Project: Libby Asbestos Remedial Investigation (RI)

Project No.: 3282-137

Client: U.S. Environmental Protection Agency

Project Manager: _____ Date: 5/7/03

Technical Reviewer: _____ Date: 5/7/03

QA Reviewer: _____ Date: 5/12/03

EPA Approval: _____ Date: 5/19/03

Reason for and duration of modification: Site-specific procedures for decontamination of Libby amphibole asbestos contaminated field equipment are different than CDM Technical SOP 4-5. These modifications are necessary for the entire duration of the project.

All equipment used to collect, handle, or measure soil samples will be decontaminated in accordance with CDM Technical SOP 4-5, Field Equipment Decontamination at Nonradioactive Sites, with the following modifications:

Section 4.0, Required Equipment - Plastic sheeting will not be used during decontamination procedures. American Society for Testing and Materials (ASTM) Type II water will not be used. Rather, locally available deionized (DI) water will be used.

Section 5.0, Procedures - Decontamination water will not be captured and will be discharged to the ground at the property.

Section 5.6, Waste Disposal - Decontamination water will not be captured and will not be packaged, labeled, or stored as investigation-derived waste (IDW).

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QA Review:	Doug Updike	**Approved:**	Michael C. Mallory 12/21/04
Issued:	12/22/04		
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1.0 Objective

The objective of this standard operating procedure (SOP) is to describe the general procedures required for decontamination of field equipment at nonradioactive sites. This SOP serves as a guide and is applicable at most sites; however, it should be noted that site-specific conditions (i.e., type of contamination, type of media sampled) and the governing agency (i.e., EPA, DOE, USACE) may require modifications to the decontamination procedures provided in this SOP.

2.0 Background

2.1 Definitions

Acid Rinse - A solution of 10 percent nitric or hydrochloric acid made from reagent grade acid and analyte-free water.

Analyte-Free Water - Tap water that has been treated so that the water contains no detectable heavy metals or other inorganic compounds. Analyte-free water should be stored only in clean glass, stainless steel, or plastic containers that can be closed when not in use.

Clean - Free of visible contamination and when decontamination has been completed in accordance with this SOP.

Cross Contamination - The transfer of contaminants through equipment or personnel from the contamination source to less contaminated or noncontaminated samples or areas.

Decontamination - The process of rinsing or otherwise cleaning the surfaces of equipment to rid them of contaminants and to minimize the potential for cross contamination of samples or exposure of personnel.

Organic-Free/Analyte-Free Water - Tap water that has been treated so that the water meets the analyte-free water criteria and contains no detectable organic compounds. Organic-free/analyte-free water should be stored only in clean glass, Teflon™, or stainless steel containers that can be closed when not in use.

Potable Water - Tap water may be obtained from any municipal system. Chemical analysis of the water source may be required before it is used.

Soap - Low-sudsing, nonphosphate detergent such as Liquinox™.

Solvent Rinse - Pesticide grade, or better, isopropanol, acetone, or methanol.

2.2 Discussion

Decontamination of field equipment is necessary to ensure acceptable quality of samples by preventing cross contamination. Further, decontamination reduces health hazards and prevents the spread of contaminants offsite.

3.0 Responsibilities

Field Team Leader - The field team leader (FTL) ensures that field personnel are trained in the performance of this procedure and that decontamination is conducted in accordance with this procedure. The FTL may also be required to collect and document rinsate samples to provide quantitative verification that these procedures have been correctly implemented.

4.0 Required Equipment

- Stiff-bristle scrub brushes
- Plastic buckets and troughs
- Soap
- Nalgene or Teflon sprayers or wash bottles or 2- to 5-gallon, manual-pump sprayer (pump sprayer material must be compatible with the solution used)
- Plastic sheeting
- Disposable wipes, rags, or paper towels
- Potable water*
- Analyte-free water
- Organic-free/analyte-free water
- Gloves, safety glasses, and other protective clothing as specified in the site-specific health and safety plan
- High-pressure pump with soap dispenser or steam-spray unit (for large equipment only)
- Appropriate decontamination solutions pesticide grade or better and traceable to a source (e.g., 10 percent and/or 1 percent nitric acid [HNO_3], acetone, methanol, isopropanol, hexane)
- Tools for equipment assembly and disassembly (as required)
- 55-gallon drums or tanks (as required)
- Pallets for drums or tanks holding decontamination water (as required)

* Potable water may be required to be tested for contaminants before use. Check field plan for requirements.

5.0 Procedures

All reusable equipment (nondedicated) used to collect, handle, or measure samples will be decontaminated before coming into contact with any sample. Decontamination of equipment will occur either at a central decontamination station or at portable decontamination stations set up at the sampling location, drill site, or monitoring well location. The centrally located decontamination station will include an appropriately sized bermed and lined area on which equipment decontamination will occur and shall be equipped with a collection system and storage vessels. In certain circumstances, berming is not required when small quantities of water are being generated and for some short duration field activities (i.e., pre-remedial sampling). Equipment should be transported to the decontamination station in a manner to prevent cross contamination of equipment and/or area. Precautions taken may include enclosing augers in plastic wrap while being transported on a flatbed truck.

The decontamination area will be constructed so that contaminated water is either collected directly into appropriate containers (5-gallon buckets or steel wash tubs) or within the berms of the decontamination area that then drains into a collection system. Water from the collection system will be transferred into 55-gallon drums or portable tanks for storage. Typically, decontamination water will be staged until sampling results or waste characterization results are obtained and evaluated and the proper disposition of the waste is determined. The exact procedure for decontamination waste disposal should be discussed in the field plan. Also, solvent and acid rinse fluids may need to be segregated from other investigation-derived wastes.

All items that will come into contact with potentially contaminated media will be decontaminated before use and between sampling and/or drilling locations. If decontaminated items are not immediately used, they will be covered either with clean plastic or aluminum foil depending on the size of the item. All decontamination procedures for the equipment being used are as follows:

General Guidelines

- Potable, analyte-free, and organic-free/analyte-free water should be free of all contaminants of concern. Following the field plan, analytical data from the water source may be required.

- Sampling equipment that has come into contact with oil and grease will be cleaned with methanol or other approved alternative to remove the oily material. This may be followed by a hexane rinse and then another methanol rinse. Regulatory or client requirements regarding solvent use will be stated in the field plan.

- All solvents and acids will be pesticide grade or better and traceable to a source. The corresponding lot numbers will be recorded in the appropriate logbook. Solvents and acids are potentially hazardous materials and must be handled, stored, and transported accordingly. Solvents should never be used in a closed building. See the site-specific health and safety plan and/or the chemical's Material Safety Data Sheet (MSDS) for specific information regarding the safe use of the chemical.

- Decontaminated equipment will be allowed to air dry before being used.

- Documentation for all cleaning will be recorded in the appropriate logbook.

- Gloves, boots, safety glasses, and any other personnel protective clothing and equipment will be used as specified in the site-specific health and safety plan.

5.1 Heavy Equipment Decontamination

Heavy equipment includes drilling rigs and backhoes. Follow these steps when decontaminating this equipment:

- Establish a bermed decontamination area that is large enough to fully contain the equipment to be cleaned. If available, an existing wash pad or appropriate paved and bermed area may be used; otherwise, use one or more layers of heavy plastic sheeting to cover the ground surface and berms. All decontamination pads should be upwind of the area under investigation.

- With the rig in place, spray areas (rear of rig or backhoe) exposed to contaminated soils using a hot water high-pressure sprayer. Be sure to spray down all surfaces, including the undercarriage.

- Use brushes, soap, and potable water to remove dirt whenever necessary.

- Remove equipment from the decontamination pad and allow it to air dry before returning it to the work site.

- Record the equipment type, date, time, and method of decontamination in the appropriate logbook.

- After decontamination activities are completed, collect all contaminated wastewater, plastic sheeting, and disposable gloves, boots, and clothing in separate containers or receptacles. All receptacles containing contaminated items must be properly labeled for disposal as detailed in the field plan. Liquids and solids must be drummed separately.

5.2 Downhole Equipment Decontamination

Downhole equipment includes hollow-stem augers, drill pipes, rods, stems, etc. Follow these steps when decontaminating this equipment:

- Set up a centralized decontamination area, if possible. This area should be set up to collect contaminated rinse waters and to minimize the spread of airborne spray.

- Set up a "clean" area upwind of the decontamination area to receive cleaned equipment for air-drying. At a minimum, clean plastic sheeting must be used to cover the ground, tables, or other surfaces on which decontaminated equipment is to be placed. All decontamination pads should be upwind of any areas under investigation.

- Place the object to be cleaned on aluminum foil or plastic-covered wooden sawhorses or other supports. The objects to be cleaned should be at least 2 feet above the ground to avoid splashback when decontaminating.

- Using soap and potable water in the hot water high-pressure sprayer (or steam unit), spray the contaminated equipment. Aim downward to avoid spraying outside the decontamination area. Be sure to spray inside corners and gaps especially well. Use a brush, if necessary, to dislodge dirt.

- If using soapy water, rinse the equipment using clean, potable water. If using hot water, the rinse step is not necessary if the hot water does not contain a detergent. If the hot water contains a detergent, this final clean water rinse is required.

- Using a suitable sprayer, rinse the equipment thoroughly with analyte-free water.

- Remove the equipment from the decontamination area and place in a clean area upwind to air dry.

- Record equipment type, date, time, and method of decontamination in the appropriate logbook.

- After decontamination activities are completed, collect all contaminated wastewaters, plastic sheeting, and disposable gloves, boots, and clothing in separate containers or receptacles. All receptacles containing contaminated items must be properly labeled for disposal. Liquids and solids must be drummed separately.

5.3 Sampling Equipment Decontamination

Sampling equipment is defined as equipment that comes into direct contact with the sample media. Such equipment includes split spoon samplers, well casing and screens, and spatulas or bowls used to homogenize samples. Follow these steps when decontaminating this equipment:

- Set up a decontamination line on plastic sheeting. The decontamination line should progress from "dirty" to "clean." A clean area shall be established upwind of the decontamination wash/rinse activities to dry the equipment. At a minimum, clean plastic sheeting must be used to cover the ground, table, or other surfaces that the decontaminated equipment is placed for drying.

- Disassemble any items that may trap contaminants internally. Do not reassemble the items until decontamination and air drying are complete.

- Wash the items with potable water and soap using a stiff brush as necessary to remove particulate matter and surface films. The items may be steam cleaned using soap and hot water as an alternative to brushing. Note that polyvinyl chloride or plastic items should not be steam cleaned. Items that have come into contact with concentrated and/or oily contaminants may need to be rinsed with a solvent such as hexane and allowed to air dry prior to this washing step.

- Thoroughly rinse the items with potable water.

- If sampling for metals, thoroughly rinse the items with an acid solution (e.g., 10 percent nitric acid) followed by a rinse using analyte-free water. If sampling for organic compounds, thoroughly rinse the items with solvent (e.g., isopropanol) followed by a rinse using analyte-free water. The specific chemicals used for the acid rinse and solvent rinse phases should be specified in the work plan. The acid rinsate and solvent rinsate must each be containerized separately. Acids and solvents are potentially hazardous materials and care must be exercised when using these chemicals to prevent adverse health affects (e.g., skin burns, irritation to the eyes and respiratory system, etc.). Appropriate personal protective equipment must be worn when using these chemicals. These chemicals (including spent rinsate) must be managed and stored appropriately. Special measures such as proper labels, paperwork, notification, etc. may be required when transporting or shipping these chemicals.

- Rinse the items thoroughly using organic-free/analyte-free water.

- Allow the items to air dry completely.

- After drying, reassemble the parts as necessary and wrap the items in clean plastic wrap or in aluminum foil.
- Record equipment type, date, time, and method of decontamination in the appropriate logbook.
- After decontamination activities are completed, collect all contaminated waters, used solvents and acids, plastic sheeting, and disposable personal protective equipment. Place the contaminated items in properly labeled drums for disposal. Liquids and solids must be drummed separately. Refer to site-specific plans for labeling and waste management requirements.

5.4 Pump Decontamination

Follow the manufacturer's recommendation for specified pump decontamination procedures. At a minimum, follow these steps when decontaminating pumps:

- Set up the decontamination area and separate "clean" storage area using plastic sheeting to cover the ground, tables, and other surfaces. Set up four containers: the first container shall contain dilute (nonfoaming) soapy water, the second container shall contain potable water, the third container shall be empty to receive wastewater, and the fourth container shall contain analyte-free water.
- The pump should be set up in the same configuration as for sampling. Submerge the pump intake (or the pump, if submersible) and all downhole-wetted parts (tubing, piping, foot valve) in the soapy water of the first container. Place the discharge outlet in the wastewater container above the level of the wastewater. Pump soapy water through the pump assembly until it discharges to the waste container. Scrub the outside of the pump and other wetted parts with a metal brush.
- Move the pump assembly to the potable water container while leaving discharge outlet in the waste container. All downhole-wetted parts must be immersed in the potable water rinse. Pump potable water through the pump assembly until it runs clear.
- Move the pump intake to the analyte-free water container. Pump the water through the pump assembly. Pump the volume of water through the pump specified in the field plan. Usually, three pump-and-line-assembly volumes will be required.
- Decontaminate the discharge outlet by hand, following the steps outlined in Section 5.3.
- Remove the decontaminated pump assembly to the clean area and allow it to air dry upwind of the decontamination area. Intake and outlet orifices should be covered with aluminum foil to prevent the entry of airborne contaminants and particles.
- Record the equipment type, serial number, date, time, and method of decontamination in the appropriate logbook.

5.5 Instrument Probe Decontamination

Instrument probes used for field measurements such as pH meters, conductivity meters, etc. will be decontaminated between samples and after use with analyte-free, or better, water.

5.6 Waste Disposal

Refer to site-specific plans for waste disposal requirements. The following are guidelines for disposing of wastes:

- All wash water, rinse water, and decontamination solutions that have come in contact with contaminated equipment are to be handled, packaged, labeled, marked, stored, and disposed of as investigation-derived waste.
- Small quantities of decontamination solutions may be allowed to evaporate to dryness.

- If large quantities of used decontamination solutions will be generated, each type of waste should be contained in separate containers.
- Unless otherwise required, plastic sheeting and disposable protective clothing may be treated as solid, nonhazardous waste.
- Waste liquids should be sampled, analyzed for contaminants of concern in accordance with disposal regulations, and disposed of accordingly.

6.0 Restrictions/Limitations

Nitric acid and polar solvent rinses are necessary only when sampling for metals or organics respectively. These steps should not be used, unless required, because of the potential for acid burns and ignitability hazards.

If the field equipment is not thoroughly rinsed and allowed to completely air dry before use, volatile organic residue, which interferes with the analysis, may be detected in the samples. The occurrence of residual organic solvents is often dependent on the time of year sampling is conducted. In the summer, volatilization is rapid, and in the winter, volatilization is slow. Check with your EPA region, state, and client for approved decontamination solvents.

7.0 References

American Society for Testing and Materials. 2002. *Standard Practice for Decontamination of Field Equipment at Nonradioactive Waste Sites*, ASTM D5088-02. January 10.

Department of Energy. Hazardous Waste Remedial Actions Program. 1996. *Standard Operating Procedures for Site Characterization*, DOE/HWP-100/R1. September.

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U. S. Environmental Protection Agency. 1987. *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001.1.

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1.0 Objective

The objective of this standard operating procedure (SOP) is to establish the baseline requirements, procedures, and responsibilities inherent to the control and use of all measurement and test equipment (M&TE). Contractual obligations may require more specific or stringent requirements that must also be implemented.

2.0 Background

2.1 Definitions

Traceability - The ability to trace the history, application, or location of an item and like items or activities by means of recorded identification.

2.2 Discussion

M&TE may be government furnished (GF), rented or leased from an outside vendor, or purchased. It is essential that measurements and tests resulting from the use of this equipment be of the highest accountability and integrity. To facilitate that, the equipment shall be used in full understanding and compliance with the instructions and specifications included in the manufacturer's operations and maintenance and calibration procedures and in accordance with any other related project-specific requirements.

2.3 Associated Procedures

- CDM Federal (CDM) Technical SOP 4-1
- CDM Quality Procedures (QPs) 2.1 and 2.3
- Manufacturer's operating and maintenance and calibration procedures

3.0 Responsibilities

All staff with responsibility for the direct control and/or use of M&TE are responsible for being knowledgeable of and understanding and implementing the requirements contained herein as well as any other related project-specific requirements.

The project manager (PM) or designee (equipment coordinator, quality assurance coordinator, field team leader, etc.) is responsible for initiating and tracking the requirements contained herein.

4.0 Required Equipment

- Determine and implement M&TE related project-specific requirements
- The maintenance and calibration procedures must be followed when using M&TE
- Obtain the maintenance and calibration procedures if they are missing or incomplete
- Attach or include the maintenance and calibration procedures with the M&TE
- Prepare and record maintenance and calibration in an Equipment Log or a Field Log as appropriate (Figure 1)
- Maintain M&TE records
- Label M&TE requiring routine or scheduled calibration (when required)
- Perform maintenance and calibration using the appropriate procedure and calibration standards
- Identify and take action on nonconforming M&TE

5.0 Procedures

5.1 Determine if Other Related Project-Specific Requirements Apply

For All M&TE:
The PM or designee shall determine if M&TE related project-specific requirements apply. If M&TE related project-specific requirements apply, obtain a copy of them and review and implement as appropriate.

5.2 Obtain the Operating and Maintenance and Calibration Documents

For GF M&TE that is to be procured:
Requisitioner - Specify that the maintenance and calibration procedures be included.

For GF M&TE that is acquired as a result of a property transfer:
Receiver - Inspect the M&TE to determine whether maintenance and calibration procedures are included with the item. If missing or incomplete, order the appropriate documentation from the manufacturer.

For M&TE that is to be rented or leased from an outside vendor:
Requisitioner - Specify that the maintenance and calibration procedures, the latest calibration record, and the calibration standards certification be included. If this information is not delivered with the M&TE, ask Procurement to request it from the vendor.

5.3 Prepare and Record Maintenance and Calibration Records

For all M&TE:
PM or Designee - Record all maintenance and calibration events in a Field Log unless other project-specific requirements apply.

For GF M&TE only (does not apply to rented or leased M&TE):
If an Equipment Log is a project specific requirement, perform the following:

Receiver - Notify the PM or designee for the overall property control of the equipment of the receipt of an item of M&TE.

PM or Designee - Prepare a sequentially page numbered Equipment Log for the item using the maintenance and calibration form (or equivalent) from the CDM *Property Control Manual* (Figure 1).

PM or Designee and User - Record all maintenance and calibration events in an Equipment Log.

5.4 Label M&TE Requiring Calibration

For GF M&TE only (does not apply to rented or leased M&TE):
If calibration labeling is a project specific requirement, perform the following:

PM or Designee - Read the maintenance and calibration procedures to determine the frequency of calibration required.

PM or Designee - If an M&TE item requires calibration before use, affix a label to the item stating "Calibrate Before Use."

PM or Designee - If an M&TE item requires calibration at other scheduled intervals, e.g., monthly, annually, etc., affix a label listing the date of the last calibration, the date the item is next due for a calibration, the initials of the person who performed the calibration, and a space for the initials of the person who will perform the next calibration.

5.5 Operating, Maintaining or Calibrating an M&TE Item

For all M&TE:
PM or Designee and User - Operate, maintain, and calibrate M&TE in accordance with the maintenance and calibration procedures. Record maintenance and calibration actions in the Equipment Log or Field Log.

Figure 1

CDM
A subsidiary of Camp Dresser & McKee Inc.

Maintenance and Calibration

Date: Time: (AM/PM)
Employee Name:
Contract/Project:
Activity: _____

Equipment Description:
Equipment ID No.:
Equipment Serial No.: _____

Maintenance Performed:

Comments:

Signature: _____ Date: _____

Calibration Standard:
Lot No. of Calibration Standard:
Pre-Calibration Reading:
Additional Readings:
Additional Readings:
Pre-Field Check Reading:

Concentration of Standard:
Expiration Date of Calibration Standard:
Post-Calibration Reading:
Additional Readings:
Additional Readings:
Post-Field Check Reading:

Adjustment(s):

Calibration: ☐ Passed ☐ Failed

Comments:

Signature: _____ Date: _____

5.6 Shipment

For GF M&TE:

Shipper - Inspect the item to ensure that the maintenance and calibration procedures are attached to the shipping case, or included, and that a copy of the most recent Equipment Log entry page (if required) is included with the shipment. If the maintenance and calibration procedures and/or the current Equipment Log page (if required) is missing or incomplete, do not ship the item. Immediately contact the PM or designee and request a replacement.

For M&TE that is rented or leased from an outside vendor:

Shipper - Inspect the item to ensure that the maintenance and calibration procedures and latest calibration and standards certification records are included prior to shipment. If any documentation is missing or incomplete, do not ship the item. Immediately contact Procurement and request that they obtain the documentation from the vendor.

5.7 Records Maintenance

For GF M&TE:

PM or Designee - Create a file upon the initial receipt of an item of M&TE or calibration standard. Organize the files by contract origin and by M&TE item and calibration standard. Store all files in a cabinet, file drawer, or other appropriate storage media at the pertinent warehouse or office location.

PM or Designee - Maintain all original documents in the equipment file except for the packing slip and Field Log.

Receiver - Forward the original packing slip to Procurement and a photocopy to the PM or designee.

PM or Designee - File the photocopy of the packing slip in the M&TE file.

PM or Designee and User - Record all maintenance and calibration in an Equipment Log or Field Log (as appropriate.) File the completed Equipment Logs in the M&TE records. Forward completed Field Logs to the PM for inclusion in the project files.

For M&TE rented or leased from an outside vendor:

Receiver - Forward the packing slip to Procurement.

User - Forward the completed Field Log to the PM for inclusion in the project files.

User - Retain the most current maintenance and calibration record and calibration standards certifications with the M&TE item and forward previous versions to the PM for inclusion in the project files.

5.8 Traceability of Calibration Standards

For all items of M&TE:

PM or Designee and User - When ordering calibration standards, request nationally recognized standards as specified or required. Request commercially available standards when not otherwise specified or required. Or, request standards in accordance with other related project-specific requirements.

PM or Designee and User - Require certifications for standards that clearly state the traceability.

PM or Designee and User - Note standards that are perishable and consume or dispose of them on or before the expiration date.

PM or Designee - Require Material Safety Data Sheet to be provided with standards.

5.9 M&TE That Fails Calibration

For any M&TE item that cannot be calibrated or adjusted to perform accurately:

PM or Designee - Immediately discontinue use and segregate the item from other equipment. Notify the appropriate PM and take appropriate action in accordance with the CDM QP 2.3 for nonconforming items.

PM or Designee - Review the current and previous maintenance and calibration records to determine if the validity of current or previous measurement and test results could have been affected and notify the appropriate PM(s) of the results of the review.

6.0 Restrictions/Limitations

On an item-by-item basis, exemptions from the requirements of this SOP may be granted by the HDQ health and safety manager and/or HDQ quality assurance director. All exemptions shall be documented by the grantor and included in the equipment records as appropriate.

7.0 References

CDM Federal Programs Corporation *Property Control Manual.* 2002. March.

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 8

STANDARD OPERATING PROCEDURE (SOP) FOR THE SAMPLING OF ASBESTOS FIBERS IN AIR

Prepared by: _____ for W. Brattin (Author) Date: 3/8/01

Reviewed by: _____ (Project Director) Date: 3/8/01

_____ (Quality Assurance Coordinator) Date: 3/8/01

Approved by: _____ for Paul Peronard (Project Manager) Date: 3/9/01

REVISION LOG

Revision Date	Reason for Revision
02/28/01	--
03/07/01	Further define pump calibration procedures.

PROCEDURAL SECTION

1.0 Scope and Applicability

This Standard Operating Procedure (SOP) provides a standardized method for sampling air to measure the concentration of asbestos fibers. This SOP is applicable to any type of asbestos fiber (amphibole, chrysotile) that may exist in air (either indoor or outdoor), and is applicable to both personal and ambient air (referred as stationary air throughout this SOP) sampling techniques. Filters collected in this way are suitable for examination by a variety of microscopic techniques, including TEM, PCM, and SEM.

2.0 Summary of Method

This SOP is based on air sampling techniques described in EPA SOP 2015, ISO 10312, OSHA Technical Manual, NIOSH 7400 and NIOSH 7402.

Air is drawn through a fine-pore filter in order to trap any suspended particulate matter in the air, including suspended asbestos fibers and other mineralogic materials. The filters are then examined using an appropriate microscopic technique to observe, characterize and quantify the number of asbestos fibers on the filter. The concentration of fibers in air is then calculated by dividing the total number of fibers on the filter by the volume of air drawn through the filter.

3.0 Health and Safety Warnings

Asbestos fibers are hazardous to human health when inhaled. Exposure to excessive levels may increase the risk of lung cancer, mesothelioma, and asbestosis. All personnel engaged in collection of air samples in areas where asbestos fibers may be present must have adequate health and safety training and must wear an appropriate level of personal protective equipment (PPE). Refer to the Health and Safety Plan for further details.

4.0 Cautions

None, refer to Section 3.0.

5.0 Interferences

High levels of dust or other suspended particulates may clog or overload the filter and reduce the ability to observe and characterize asbestos fibers on the filters. Precautions should be taken to avoid any unnecessary sources of dust emissions or use of aerosol sprays. Sampling conditions

(flow rate, sampling time) should be adjusted accordingly to avoid filter overload.

6.0 Personnel Qualifications

Field personnel engaged in collection of filter cassettes must be trained in the proper use and calibration of the air sampling equipment (as specified in this SOP), as well as proper methods for data recording and sample handling. Additionally, all field personnel must maintain appropriate and current training and/or certifications to meet all federal, state, and local regulations.

7.0 Apparatus and Equipment

Filter Cassettes

All samples will be collected on conductive filter holders consisting of 25-mm diameter, three piece filter cassettes having a 50-mm long electrically conductive extension cowl. The cassette shall be pre-loaded with a mixed cellulose ester (MCE) filter with pore size 0.8 um. Use of the 0.8 um pore size is recommended for all samples so that samples collected using a high volume pump are comparable to samples collected with a low volume pump. The 0.8 um pore size filters are used for samples collected with a low volume pump in order to decrease back-pressure and increase flow rate.

To reduce contamination and to hold the cassette tightly together, seal the crease between the cassette base and the cowl with a shrink band or adhesive tape. If particle deposition on the inside of the cowl is observed, it may be necessary to ground the cowl to reduce static charge. This is done by attaching one end of a length of flexible wire to the plastic cowl with a hose clamp and attaching the other end of the wire to a suitable ground (e.g., a cold water pipe).

Air Pumps

The sampling pump used shall provide a non-fluctuating airflow through the filter and shall maintain the initial flow rate within ± 10% throughout the sampling period.

A variety of different types of air pump may be used, depending on the flow rates that are required to achieve the data quality objectives and desired analytical sensitivity of the project. In general, the pump should be selected to deliver a flow rate that is as high as possible without overloading the filter with dust or fibers. The minimum flow rate is 0.5 L/min, and rates up to 10 L/min may be appropriate in some cases.

For stationary air monitors, a high volume pump that operates on AC power is recommended. For personal air sampling, either a portable high volume AC powered sampler or a low volume

battery-operated pump are acceptable, depending on whether the activities of the individual are impaired by the tethering imposed by the power cord needed for the high volume pump.

Tripod

For stationary air monitors, a tripod or other similar device is required to hold the filter cassette at a specified elevation above the floor. As noted below, this will typically be a height that represents the breathing zone (1.5-2 meters).

Spring Clips

For personal air monitors, the filter cassette is held in place using spring clips or other similar devices.

Rotameter

A rotameter that has been calibrated to a primary calibration source is required to calibrate the air flow rate at the start and the end of each sampling period. Due to its dependency on changes in atmospheric pressure, the rotameter must be calibrated to a primary calibration source at the site location (e.g., City of Libby) prior to sampling and re-calibrated on-site every week. Record calibration and re-calibration to the primary standard in the field logbook.

Primary Calibration Source

A bubble buret or other primary calibration standard may be used to calibrate the rotameter.

Sample Labels

A pre-printed sheet of sample labels (2 identical labels per sample number) is required. One label should be attached to the filter cassette before the sample collection period begins, and the matching label should be attached to the field data sheet that records relevant data on the sample being collected.

Field Log Book

A field log book is required to record relevant information regarding the collection of samples (location, time, unusual conditions or problems, etc.).

Field Data Sheet

A personal air or stationary air monitoring field data sheet (as appropriate) is required to record the relevant sampling information. Refer to the Phase 2 QAPP (EPA, March 2001) for the form.

8.0 Instrument Calibration

External calibration devices such as a bubble buret or a rotometer that have been calibrated to a primary calibration source may be used to calibrate air flow rate prior to air sampling. The flow rate must also be measured by the same method at the end of the sampling period.

8.1 Calibrating a Rotameter with an Electronic Calibrator (DryCal)

- See manufacturer's manual for operational instructions.
- To set up the calibration train, attach one end of the tygon tubing to the outlet plug of the rotameter; attach the other end of the tubing to the inlet plug on the pump. Another piece of tubing is attached from the inlet plug of the rotameter to the outlet plug on the DryCal.
- Rest or firmly stabilize the rotameter so that it is vertical (± 6°).
- Attach an isolating load with a pressure drop of about 10 to 20 inches of water column in series with a stable pump (a filter cassette of same lot number as will be used for field samples works well for this).
- Turn the DryCal and sampling pump on.
- Turn the flow adjust screw (or knob) on the pump until the desired flow rate is attained.
- Record the DryCal flow rate reading and the corresponding rotameter reading in the field logbook. The rotameter should be able to work within the desired flow range.
- Perform the calibration three times until the desired flow rate of ± 5% is attained. Once at the sampling location, a secondary calibrator (e.g., rotameter) may be used to calibrate sampling pumps.

8.2 Calibrating an Air Pump with a Rotameter

A rotameter can be used provided it has been precalibrated to a primary calibration source at the site location (e.g., City of Libby). Three separate constant flow calibration readings should be obtained both before sampling and after sampling. The mean value of these flow rate measurements shall be used to calculate the total air volume sampled.

Turn on the sampling pump and run for 5 minutes before performing calibration.

- Remove the end plugs on the filter cassette. A cassette, representative of the lot planned for use in air sampling, must be used.
- To set up the calibration train, attach one end of the tygon tubing to the cassette base; attach the other end of the tubing to the inlet plug on the pump. Another piece of tubing is attached from the cassette cap to the rotameter.

- Rest or firmly stabilize the flow meter so that it is vertical (± 6°).
- Turn the flow adjust screw (or knob) on the sampling pump until the center of the float ball on the rotameter meets the flow rate value specified in the project plan.

9.0 Sample Collection

Apply one of the pre-printed adhesive labels to the filter cassette and apply the other to the field data sheet for the sample.

Secure the filter cassette in the appropriate sampling location. For a fixed air monitor, this will generally be at a height that represents the breathing zone of the potentially exposed population (e.g., 1.5-2 meters above the floor). For personal air monitoring, the cassette will typically be placed on the lapel just below the face of the individual being monitored. For personal air sampling for Scenarios 2 and 3 [Refer to Phase 2 QAPP (EPA March 2001)], secure the cassette on the lapel of the dominant hand of the worker. The distance from the nose/mouth of the person to the cassette should be about 10 cm. Secure the cassette on the collar or lapel using spring clips or other similar devices. In all cases, orient the cassette so the open face of the cowel is pointing downward to avoid any particles entering the filter by precipitation. Remove the protective cap over the open face of the cowel and turn on the calibrated pump. Record the starting time, the initial flow rate, and all other relevant sample data on the field data sheet for the sample. Store covers and end plugs in a clean area (e.g., a closed bag or box) during the sampling period.

For sampling events lasting longer than 2 hours, in-field pump checks should be performed approximately every 2 hours. These periodic checks should include the following activities:

- Observe the sampling apparatus (filter cassette, pump, tripod, etc.) to determine whether it's been disturbed.
- Check the pump to ensure it is working properly and the flow rate is stable at the prescribed flow rate.
- Inspect the filter for overloading and particle deposition. Inspect the filter using a small flashlight. Look for particle adhesion or deposition on the side of the cassette and check the filter surface for accumulation of visible dust or smoke particles. If particle deposition on the inside of the cowl is observed, it may be necessary to ground the cowl to reduce static charge.

After the specified sampling period has elapsed, measure the ending flow rate and ending clock time on the data sheet. Turn off the pump and remove the cassette from the pump. Attach and secure a sample seal around each sample cassette in such a way as to assure that the end cap and

base plug cannot be removed without destroying the seal. Tape the ends of the seal together since the seal is not long enough to be wrapped end-to-end. Initial and date the seal.

10. Sample Handling and Preservation

Package the cassettes so they will not rattle during shipment nor be exposed to static electricity. Place custody seals, dated and marked with the packager's signature, onto the shipping container. Do not ship samples in polystyrene peanuts, vermiculite, paper shreds, or excelsior. Tape sample cassettes to sheet bubbles and place in a container that will cushion the samples in such a manner that they will not rattle. For additional shipping requirements, see the project plan.

Ship the sealed cassette to the analytical laboratory under proper chain of custody procedures. No preservation of the cassette is required.

QUALITY CONTROL and QUALITY ASSURANCE

Pre-Project Filter ("Lot") Blanks

Before samples are collected, two cassettes from each filter lot of 100 cassettes should be randomly selected and submitted for analysis. The lot blanks will be analyzed for asbestos fibers by the same method as will be used for field samples. The entire batch of cassettes should be rejected if any asbestos fiber is detected on any filter.

Field Blanks

Blank samples are used to determine if any contamination has occurred during sample handling. Prepare two blanks (from the sample lot used for field sampling) for the first 1 to 20 samples. For sets containing greater than 20 samples, prepare blanks as 10% of the samples. Filter blanks should be taken to a sampling location and prepared there. Remove the caps on the filter cassette and hold the cassette open for about 30 seconds. Close and seal the cassette as described in Section 9. Store blanks for shipment with the sample cassettes.

REFERENCES

NIOSH 7400

NIOSH 7402

ISO 10312

OSHA Technical Manual

EPA SOP 2015

Site-Specific Sampling Guidance
Libby Superfund Site

Guidance No.: CDM-LIBBY-05, Revision 2

Guidance Title: Soil Sample Collection at Residential and Commercial Properties

Approved by:

Technical Reviewer — Date: 5/10/07

QA Reviewer — Date: 5/10/07

Volpe Center Approval — Date: 05/10/07

EPA Approval — Date: 5/10/07

Section 1
Purpose

The goal of this standard operating procedure (SOP) is to provide a consistent method for the collection of 30-point composite surface soil sampling to support all investigations conducted at the Libby Superfund Site and specified in governing guidance documents. This SOP describes the equipment and operations used for sampling surface soils in residential and commercial areas, which will be submitted for the analysis of Libby amphibole asbestos. Refer to each investigation-specific guidance documents or work plan for detailed modifications to this SOP, where applicable. The EPA Team Leader or their designate must approve deviations from the procedures outlined in this document prior to initiation of the sampling activity.

Section 2
Responsibilities

Successful execution of this SOP requires a clear hierarchy of assigned roles with different sets of responsibilities associated with each role. All staff with responsibility for the collection of soil samples is responsible for understanding and implementing the requirements contained herein as well as any other governing guidance documents.

Task Leader (TL) or Field Team Leader (FTL) - The TL or FTL is responsible for overseeing sample collection processes as described in EPA approved governing guidance documents (i.e., site-specific sampling and analysis plans [SAPs], quality assurance project plans [QAPPs], etc.). The TL or FTL is also responsible for checking all work performed and verifying that the work satisfies the specific tasks outlined by this SOP and all governing guidance documents. The TL or FTL will communicate with the field team members regarding the specific collection objectives and anticipated situations that require deviation from this SOP. It is also the responsibility of the TL or FTL to communicate the need for any deviations from the SOP with the appropriate EPA personnel (team leader or their designate), and document the deviations using a Field Modification Form provided in each SAP or QAPP.

Field team members - Field team members performing the sampling described in this SOP are responsible for adhering to the applicable tasks outlined in this procedure while collecting samples at properties associated with the Libby Superfund Site. The field team members should have limited discretion with regard to collection procedures but should exercise judgment regarding the exact location of sample points, within the boundaries outlined by the TL or FTL.

Section 3
Equipment

- Measuring tape or wheel – Used to estimate the square footage of each land use area.
- Pin flags – Used to identify composite points within each sampling area.
- Trowel or push probe - For collecting surface soil samples.
- Shovel - For collecting surface soil samples.
- Stainless steel mixing bowl - Used to mix and homogenize composite soil samples after collection. Zip-top bags may also be used for homogenization if approved by the governing guidance documents.
- Gloves - For personal protection and to prevent cross-contamination of samples (disposable, powderless plastic or latex).
- Sample container - Gallon-sized zip-top plastic bags (2 per sample).
- Field clothing and personal protective equipment (PPE) - As specified in the current version of the site health and safety plan (HASP).
- Field sprayers – Used to suppress dust during sample collection and to decontaminate nondisposable sampling equipment between samples.
- Deionized (DI) water- Used in field sprayers to suppress dust and to clean and decontaminate sampling equipment.
- Plastic bristle brush - Used to clean and decontaminate sampling equipment.
- Wipes - Disposable, paper. Used to clean and decontaminate sampling equipment.
- Aluminum foil – Used to wrap decontaminated sampling equipment in between uses to prevent contamination during transport.
- Alconox – Used to clean and decontaminate sampling equipment weekly.
- 6-mil poly bag – Used to store and dispose of investigation-derived waste (IDW).
- Trash bag - Used to store and dispose of general trash.
- Field logbook/PDA - Used to record progress of sampling effort and record any problems and field observations.

- Visual Vermiculite Estimation Form (VVEF) – Used to record semi-quantitative estimates of visual vermiculite at each sub-sample location and point inspection (PI).
- Permanent marking pen - Used to label sample containers.
- Sample ID Labels (Index IDs)– Pre-printed stickers used to label sample containers.
- Cooler or other rigid container - Used to store samples while in the field.
- Custody Seals - For ensuring integrity of samples while in the field and during shipping.

Section 4
Sampling Approach

Upon arrival at each property, the field team will locate all parcels requiring sample collection depending on the investigation-specific objectives detailed in governing guidance documents. Parcels on a property will be sectioned into zones that share a similar land use. Zones established by land use areas may be subdivided based on site conditions (e.g., access, construction setup considerations, etc.). Use areas include:

- Specific Use Area (SUA): flowerbed, garden, flowerpot, stockpile, play area, dog pen, driveway (non-paved), parking lot (non-paved), road (non-paved), alley (non-paved)
- Common Use Area (CUA): yard, former garden, former flowerbed, walkway
- Limited Use Area (LUA): pasture, maintained/mowed field, overgrown areas with trails/footpaths, overgrown areas in between SUAs/CUAs
- Interior Surface Area (ISA): soil floor of garage, pumphouse, shed, crawlspace, earthen basement
- Non-Use Areas(NUA): wooded lot, un-maintained field. NUAs will be identified but will not be sampled at this time because they are not presently considered a complete exposure pathway. However, to the extent that NUAs may become a complete exposure pathway in the future, EPA may revisit NUAs at a later date.

After areas have been designated as zones (i.e., SUA zones, CUA zones, LUA zones, NUA zones, ISA zones), the field team will measure the zones with a measuring wheel and label the zone type and approximate square footage on the field sketch and/or design drawings. There is not a minimum or maximum square footage restriction on any zone.

In establishing zones at the property, no area type may be combined with any other area type. For example, driveways and flowerbeds are both SUAs but will be

separated into unique zones for soil sampling. Similarly, large CUAs such as yards may be subdivided into front yard, side yard, and back yard zones dependent on site conditions. Sectioning properties into additional zones will be at the discretion of the FTL but consistent among the teams. Conversely, not all land use areas previously mentioned will be applicable at every property.

It is anticipated that SUAs and ISA zones will generally tend to be smaller parcels. Combining small, proximal SUAs into one zone will be at the discretion of the FTL but consistent among teams. With the exception of proximal SUAs, all other land use areas will be contiguous when establishing zones at each property.

Composite sampling requires soil collection from multiple (sub-sample) points. Composite samples will be collected from similar land use areas (i.e., SUA, CUA, etc.) and will not be combined with any other use area. One composite sample will be collected from each zone that does not contain visual vermiculite.

For SUAs (e.g., driveway, garden, dog pen, etc.), composite samples will be collected from the 0- to 6-inch depth interval. If a depth of 6 in. cannot be attained given the varying levels of compaction in driveways, roads, etc. the maximum depth attainable will be documented in the field logbook/PDA. For non-SUAs (e.g., yard, former flowerbed, crawlspace, etc.), composite samples will be collected from 0 to 3 inches. All composite soil samples will have 30 sub-samples (i.e., 30-point composite sample) of approximately equal size for a final sample volume between 2,000 and 2,500 grams. Table 1 lists the sample depth for each type of land use area.

Table 1 Sampling Area and Depth

Land Use Area	Label	Sampling Depth (Inches)
Special Use Area	SUA	0 – 6
Common Use Areas	CUA	0 – 3
Limited Use Area	LUA	0 – 3
Non-Use Area	NUA	Not Sampled
Interior Surface Zone	IS	0 – 3

As each sub-sample is collected, the soil will be inspected for visual vermiculite (VV) and the location and semi-quantitative estimates of VV will be recorded as prescribed in the SOP for Semi-Quantitative Visual Estimation of Vermiculite in Soil, Revision 1 (CDM 2007a).

Areas of SUAs with VV will not be sampled. Instead, the location will be recorded in the field logbook/PDA and on the field sketch or design drawing. If the SUA is of substantial size (greater than 1000 square feet [ft^2]), and the VV is localized, additional PIs will be collected to determine the extent of VV and a sample will be collected from the remainder of the zone that does not contain VV. If the SUA measures less than 1,000 ft^2 and VV is present, a sample will not be collected from that SUA. Proximal

SUAs will not be combined into a SUA zone if VV is present. If visible vermiculite is not observed, proceed with sample collection of the SUA zone

Section 5
Sample Collection

Don the appropriate PPE as specified in the governing HASP. A new pair of disposable gloves is to be worn for each sample collected. Segregate land use areas on the property into zones as described in Section 4. To reduce dust generation during sampling, use a sprayer with DI water to wet each sub-sample location prior to collection. Use the trowel to check beneath the surface soil layer, but do not advance more than 6 inches. If VV is observed, record the information on the field sketch or design drawing. If VV is observed within a large SUA, do not collect a sample from the area containing VV as described above.

Within each zone, select 30 sub-sample locations equidistant from each other. These 30 sub-sample locations will comprise the 30-point composite sample for that zone. All composite sub-samples will originate from the same land use area. For example, do not mix sub-samples from SUAs with sub-samples from LUAs.

Clean the sub-sample locations of twigs, leaves, and other vegetative material that can be easily removed by hand. Using the trowel or push probe, excavate a hole in the soil approximately 2 inches in diameter and 6 inches deep for SUAs, or 3 inches deep for non-SUAs, while placing the excavated material directly inside the gallon-sized zip-top plastic bag. Repeat this step for each subsequent sub-sample until the appropriate number of composite sub-samples has been collected. As each sub-sample is collected, inspect the location for VV as prescribed in the SOP for Semi-Quantitative Visual Estimation of Vermiculite in Soil, Revision 1 (CDM 2007a).

Samples collected from zones measuring greater than 3,000 ft^2 will require additional PIs to inspect the soil for VV, but no more than 30 sub-samples will be collected from a zone for each composite sample. Samples collected from zones measuring less than 3,000 ft^2 will have the same number of sub-samples as PIs unless additional PIs are required to identify the extent of localized VV.

Homogenize the sample as required by governing guidance documents. Once the sample is homogenized, fill the zip-top plastic bag to 1/3rd full (approximately 2000 grams). Affix the sample index ID label to the inside of the bag and write the index ID number on the outside of the bag, or affix an additional label using clear packing tape. Sample index ID numbers will be assigned based on the investigation-specific guidance document. Double bag the sample and repeat the labeling process for the outer bag. Decontaminate equipment between composite samples as described in Section 8.

Repeat steps outlined above until all samples from a property have been collected.

Soil field duplicate samples will be collected at the rate specified in governing guidance documents. Field duplicate samples will be collected as samples co-located in the same zone. The duplicate will be collected from the same number of sub-samples as the parent sample, but the sub-sample locations of the duplicate sample will be randomly located in the zone. The inspection for VV at each sub-sample location will follow the same protocol as referenced above. These samples will be independently collected with separate sampling equipment or with the original sampling equipment after it has been properly decontaminated. For tracking purposes, the parent/duplicate sample relationship will be recorded in accordance with sample documentation requirements stated in the governing guidance document. These samples will be used to determine the variability of sample results in a given land use area. These samples will not be used to determine variability in sampling techniques.

Section 6
Site Cleanup

IDW will be managed as prescribed in Section 3.2.10 of the Site-wide QAPP [SWQAPP] (CDM 2007b) or other applicable governing guidance documents. In general, replace the soil plug with excess sample volume. The soil should be placed back into the hole and tamped down lightly. If sandy areas such as playgrounds are sampled, refilling the soil plug is not necessary.

Rinse water, the roots of vegetation removed during sampling, and any excess soil volume may be returned to the sampled area.

Section 7
Documentation

A field logbook/PDA will be maintained by each individual or team that is collecting samples as prescribed in Section 3.2.4 of the SWQAPP (CDM 2007b) or other applicable governing guidance documents. Guidance documents will detail conditions which require attention, but at a minimum the following information should be collected:

- Project name
- Title of governing documents
- Property address
- Date
- Time
- Team members

- Weather conditions
- PPE used
- Locations of any samples or sub-samples that could not be acquired
- Descriptions of any deviations to the SAP or SOP and the reason for the deviation
- Relinquishment of samples to project sample coordinator

Complete required documentation as detailed in applicable governing guidance documents.

Section 8
Quality Assurance/Quality Control

Quality control samples will include:

- Field duplicates

Detailed information on QC sample collection and frequency is prescribed in Section 3.1.3.2 of the SWQAPP (CDM 2007b) or other applicable governing guidance documents.

Section 8
Decontamination

All sampling equipment must be decontaminated prior to reuse. Specific instructions on sample equipment decontamination are included in the applicable governing guidance documents. In general, the procedure to decontaminate all soil sampling equipment is outlined below:

- Remove all visible contamination with plastic brush
- Use DI water and plastic brush to wash each piece of equipment
- Remove excess water present on the equipment by shaking
- Use a paper towel to dry each piece of equipment
- Wrap dried equipment in aluminum foil

Once a week all soil sampling equipment will be cleaning using Alconox and DI water.

Spent wipes, gloves, aluminum foil, and PPE must be disposed of or stored properly as IDW, specified in Section 3.2.10 of the SWQAPP (CDM 2007b) or other applicable governing guidance documents.

Section 9
Sample Custody

Field sample custody and documentation will follow the requirements described in Section 3.2.11 of the SWQAPP (CDM 2007b) or other applicable governing guidance documents.

Section 10
Glossary

Governing guidance documents - The written document that spells out the detailed site-specific procedures to be followed by the project leader and the field personnel for completing specific investigations. These documents will clearly indicate specific requirements for the implementation of this SOP.

Libby Superfund Site – The Libby Superfund Site contains all buildings and land within the boundaries of each operable unit (OU) of the site and illustrated on the most recent version of the OU boundary map.

Sub-sample - The actual location at which the sample is taken. The dimension of a sample point is 2 inches across by 3 inches deep (6 inches for SUAs).

Composite Sampling - A sample program in which multiple sample points are compiled together and submitted for analysis as a single sample.

Land Use Area - A section of property segregated by how the property owner uses the area. The area can be classified as a SUA, LUA, CUA, ISA, or NUA.

Section 11
References

CDM. 2007a. Semi-Quantitative Visual Estimation of Vermiculite in Soils at Residential and Commercial Properties, Revision 1. CDM-LIBBY-06.

CDM. 2007b. Site-Wide Quality Assurance Project Plan. Draft in review.

Site-Specific Sampling Guidance
Libby Superfund Site

SOP No.: CDM-LIBBY-06, Revision 1

SOP Title: Semi-Quantitative Visual Estimation of Vermiculite in Soils at Residential and Commercial Properties

Approved by:

Technical Reviewer — 5/10/07 Date

QA Reviewer — 5/10/07 Date

Volpe Center Approval — 05/10/07 Date

EPA Approval — 5/10/07 Date

Section 1
Purpose

EPA will identify and delineate the extent of any visible vermiculite (VV) present in soils as part of all investigations conducted at the Libby Superfund Site and specified in governing guidance documents. The goal of this standard operating procedure (SOP) is to provide a consistent approach to identify and characterize any VV present in soils.

The semi-quantitative approach presented in this SOP for visually estimating VV in soil will be revised as required to optimize data collection as the sampling teams gain experience. This will be accomplished by expanding and/or improving this SOP, supporting pictorial standards, and additional electronic data acquisition efforts, as necessary.

Section 2
Definitions

Specific Use Area (SUA) - Discrete exterior parcels on a property with a designated specific use. Due to the nature of activities typically carried out in SUAs, residents may be especially vulnerable to exposures when Libby amphibole asbestos (LA) contaminated soil becomes airborne. SUAs may be bare or covered with varying amounts of vegetation. SUAs include:

- Flower Pot
- Flowerbed
- Garden
- Stockpile
- Play Area
- Dog Pen
- Driveway (non-paved)
- Parking Lot (non-paved)
- Road (non-paved)
- Alley (non-paved)

Common Use Area (CUA) - Exterior parcels on a property with varied or generic use. CUAs may be bare or covered with varying amounts of vegetation. CUAs include:

- Walkway
- Yard (front, back, side, etc.)
- Former Garden
- Former Flowerbed

Limited Use Area (LUA) - Exterior parcels on a property that are accessed, utilized, and maintained on a very limited basis. LUAs may be bare or covered with varying amounts of vegetation. LUAs include:

- Pasture
- Maintained/Mowed Fields
- Underneath porches/decks[1]
- Overgrown Areas (with trails/footpaths, or between SUAs/CUAs)

Interior Surface Area (ISA) - Interior soil surfaces of buildings such as garages, pumphouses, sheds, and crawlspaces.

Non-Use Area (NUA) - Exterior parcels on a property with no current use (e.g., areas that are un-maintained and not accessed). NUAs may be bare or covered with varying amounts of vegetation. NUAs include:

- Wooded Lots
- Un-maintained Fields

Since NUAs are not currently accessed, they are not presently considered a complete exposure pathway. As such, semi-quantitative visual estimates of vermiculite in soil will not be captured at this time. However, to the extent that NUAs may become a complete exposure pathway in the future, EPA may revisit these NUAs at a later date.

Zone[2] - Parcels on a property that share a similar land use or subdivisions of a land use area based on site conditions (e.g., access, construction setup considerations, etc.) or sampling requirements. No area type may be combined with any other area type. For example, driveways and flowerbeds are both SUAs but will be separated into unique zones for visual inspection. Similarly, large CUAs such as yards may be subdivided into front yard, side yard, and back yard zones dependent on site conditions. Sectioning properties into additional zones will be at the discretion of the field team leader but consistent among the teams.

It is anticipated that SUAs and ISA zones will generally tend to be smaller parcels. Combining small, proximal SUAs into one zone will be at the discretion of the field team leader but consistent among teams. No ISA will be combined with any other ISA for visual inspection. There is not a maximum square footage restriction on any zone.

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[1] The soils underneath porches and decks will be classified as LUAs depending on ground clearance and accessibility to homeowners and pets. If these areas are not accessible, they will be classified as NUAs.
[2] The restriction on the maximum square footage of SUA zones (1,000 ft2) and non-SUA zones (2, 500 ft2) was eliminated from the previous iteration of this SOP after the data were reviewed by EPA and determined to sufficiently characterize the presence of VV regardless of zone square footage. Additionally, this will allow the flexibility necessary for field teams to identify areas of zones most cost effectively for removal purposes.

Point Inspection (PI) - Used in SUA, CUA, LUA, and ISA zones. A PI is an intrusive visual inspection of the top portions of the soil at a randomly selected point within a zone. A PI consists of the active displacement of the surface soil with a small shovel and visual inspection of the displaced soil to determine if VV is present. If VV is observed during the PI, the location and a semi-quantitative estimate of VV contamination will be recorded.

Section 3
Applicability

This SOP applies to properties within the Libby Superfund Site at varying stages of the removal process including, but not limited to, all screening and risk-based investigations, pre-design inspections, and removal actions. Investigation-specific modifications to this SOP are outlined in the governing guidance document for each investigation. The following locations on a property will be evaluated for the presence/absence of VV:

- All parcels on a property where soil samples are being collected.
- All parcels on a property where soil was non-detect for LA during previous sampling activities.
- All SUA parcels on a property that have not been previously characterized as containing VV

Section 4
Procedure

Figure 1 illustrates the procedures and decision rules for this SOP. The three primary procedural steps are listed below:

- Establish zones
- Perform PI
- Perform semi-quantification of visual vermiculite

Each is described in the following subsections.

4.1 Establish Zones

Upon arrival at the property, the field team will locate all areas requiring sample collection (i.e., where previous soil sample results were non-detect for LA or SUAs have not been previously characterized for VV). Parcels will be identified as SUA zones, CUA zones, LUA zones, NUA zones, or ISA zones. The field team will measure the zone sizes and note them on the field sketch and/or design drawings. Zones will be assigned according to the definitions provided above.

4.2 Point Inspections[3]

As defined above, a PI is an intrusive visual inspection performed for the entire surface of a zone. Professional judgment may be used to determine the exact location of PIs; however, the following guidelines will be implemented to maintain consistency.

A minimum of 30 PIs will be evaluated per zone if sampling is required within that zone. If soil sampling is not required, a minimum of 5 PIs will be evaluated within each zone. Zones larger than 500 square feet (ft^2) will require evaluation at a minimum of 1 PI per 100 ft^2 (10 ft by 10 ft area). The PI locations will be randomly selected and will be spatially representative of the entire zone. Locations of the PIs and semi-quantitative estimates of VV (i.e., low, intermediate, or high) will be recorded on the field sketch for each PI. While a minimum of 5 PIs will be conducted per zone, there is no set maximum. Rather, the maximum number of PIs is variable – dependent upon the total area of the zone and achieving the minimum required frequency of 1 PI per 100 ft^2.

The following sections outline procedures for inspecting each use area (e.g., SUA, CUA, LUA, ISA). The procedure for semi-quantification of VV is provided in the next section.

SUA Zone:

- Visually inspect the PI point using a spade or trowel to remove any cover material, including excess debris (e.g., mulch, rock, etc.) and organic material, from the surface of the soil. Remove and visually inspect soil to a depth of 0-6 inches below ground surface[4].
- If a depth of 6 in. cannot be attained given the varying levels of compaction in driveways, roads, etc. the maximum depth attainable will be documented in the field logbook.
- Record semi-quantitative estimate of VV observed as described in the following section.
- Replace soil and cover material.
- Repeat as necessary employing procedure outlined above.

CUA and LUA Zones:

- Visually inspect the PI point using a spade or trowel, carefully removing organic material, including grass, from the surface of the soil. Remove and visually inspect soil to a depth of 0 - 3 inches below ground surface[5].

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[3] Surface Inspections- The non-intrusive visual inspection of the immediate surface of a zone was eliminated from the previous iteration of this SOP after their data were reviewed and determined by EPA to provide no additional information over that gained through Point Inspections.

[4] A soil depth of 6 inches for SUAs was chosen to approximate the depths to which digging would be expected during typical activities occurring in these SUA zones (e.g., gardening, child digging in dirt, etc.)

[5] A soil depth of 0-3 inches was chosen to approximate the depths to which soil disturbance would be most likely during typical activities occurring in these CUA and LUA zones (e.g., lawn mowing, etc.)

- Record semi-quantitative estimate of VV observed as described in the following section.
- Carefully replace all soil and organic material.
- Repeat as necessary employing procedure outlined above.

ISA Zone:

- Move items as necessary to access the soil surface.
- Visually inspect the PI points using a spade or trowel, remove and visually inspect soil to a depth of 0 - 3 inches below ground surface[6].
- Record semi-quantitative estimate of VV observed as described in the following section.
- Repeat as necessary employing procedure outlined above.

If during the PI, VV is observed to be localized within a zone, the portion with vermiculite will be denoted on the field sketch. If additional PIs are necessary to determine the boundaries of the area, approximately 10 to 20% additional PIs will be evaluated to determine the extent of localized vermiculite.

4.3 Semi-Quantification of Visual Vermiculite

During PI, the field team will estimate the quantity of vermiculite observed. Each PI location for all zones will be assigned a semi-quantitative estimate of visible vermiculite content using a 4-point scale: none (blank), low (L), intermediate (M), and high (H)[7]. For PI locations where VV is observed, semi-quantitative estimates (e.g., L, M, or H) will be recorded on the field sketch. PI locations where VV is not observed will not be recorded on the field sketch. Photographs illustrating these quantities are attached to this SOP as Figure 2. Additionally, jars of vermiculite-containing soils representing these three levels will be available for training and reference.

Under the current version of this SOP, there will be no effort to design an approach to combine vermiculite levels for PIs within or among zones. While the viability of combining semi-quantitative visual estimates within or among zones may be assessed as a pilot-scale evaluation, any PI with visible vermiculite qualifies as vermiculite-containing soil for the area represented by the inspection point or inspection zone.

[6] A soil depth of 0-3 inches was chosen to approximate the depths to which soil disturbance would be most likely during typical activities occurring in these IS zones (e.g., entering crawlspace, retrieving items from shed, etc.)

[7] Based on EPA's review of previous data, the 5-level scale VV identification scheme was not meaningful and will be reduced to a 4-level scale. As such the quantity of "Gross" VV in the previous iteration of this SOP was combined with High. Previously collected data of Gross VV should be considered analogous to High VV under this revised SOP.

Section 5
Health & Safety/Engineering Controls

All personnel will carry out visual inspections in accord with proper personal protective equipment (PPE) and other monitoring/governing requirements outlined in the most recent version of the Site Health and Safety Plan governing the work being conducted.

All visual inspections will employ appropriate engineering controls to minimize dust (e.g., wetting soil during inspection) as prescribed in the Site-Specific Standard Operating Procedure for Soil Sample Collection (CDM-LIBBY-05, Revision 2).

Section 6
Equipment Decontamination

Equipment decontamination is not required between each PI from the same zone, but is required before moving to another inspection zone. Decontamination of equipment will be conducted as required by the governing guidance documents.

Section 7
Documentation

As noted above, information about the presence of vermiculite will be recorded on the field sketch or design drawing for the property under investigation. Each zone will be marked with:

- Zone type (i.e., SUA, CUA, LUA, NUA, or ISA)
- Zone area in ft^2
- PI locations/points
- Semi-quantitative estimate of VV content for each PI (i.e., L, M, H)

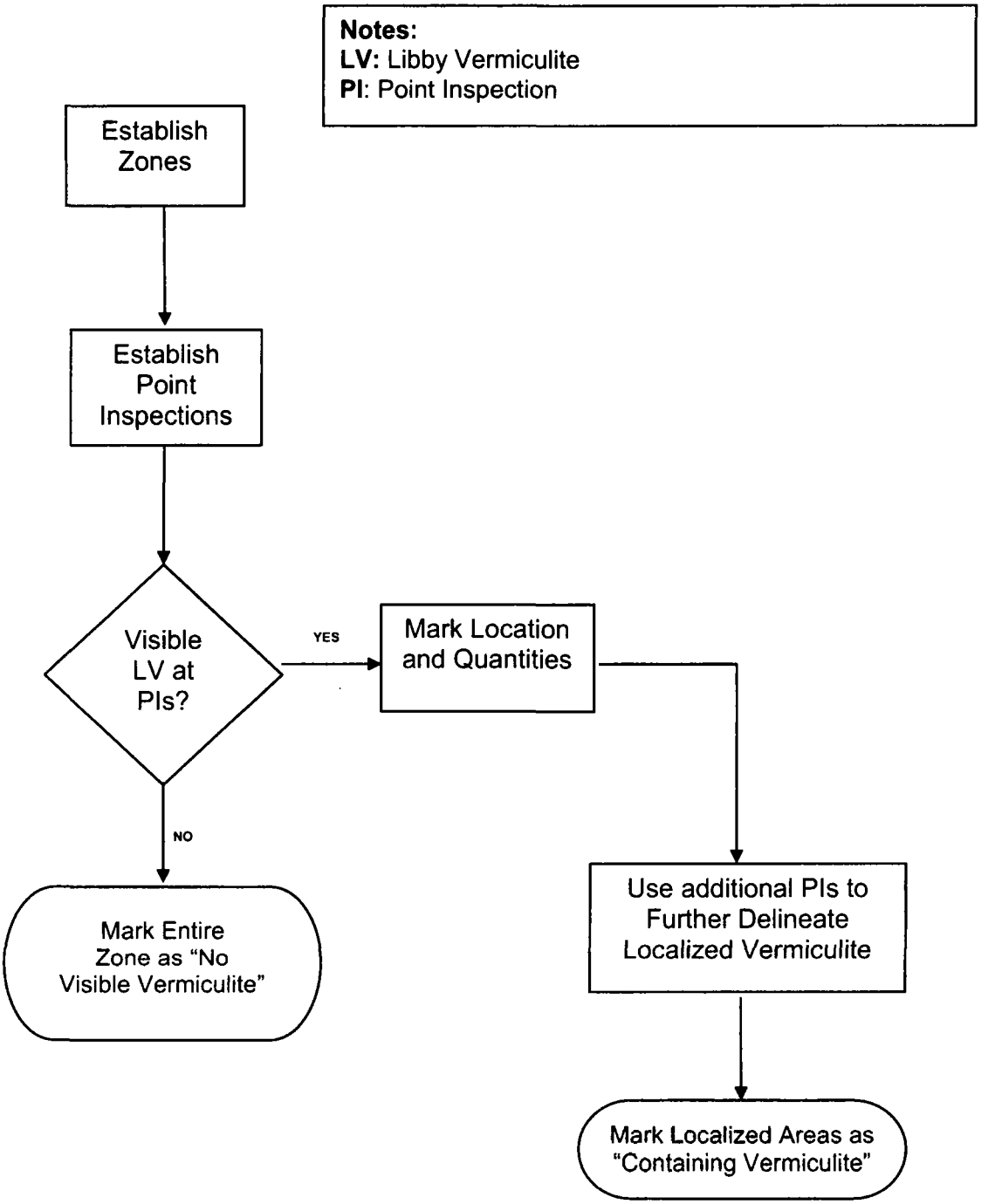
In addition to field sketch/design drawing documentation, each field team will generate a Visual Vermiculite Estimation Form (VVEF) (Figure 3) to document the semi-quantitative visual estimates of VV for each PI for possible future information use. This form will be managed according to governing guidance documents.

Section 8
Training

Every effort will be made to ensure consistency in the semi-quantitative evaluation of VV in soil to the extent possible. This will include training (e.g., field calibration), specimen examples (i.e., jars/photographs of low, intermediate, and high quantities of vermiculite, etc.), designated field staff, and oversight by the field team leader. Figures illustrating none, low, intermediate, and high quantities of vermiculite are attached to this SOP for reference (Figure 2).

To ensure consistency over time, the field team leader will verify semi-quantitative assignments at a rate of one property per team per week. The field team leader will sign off on those field sketches that were verified. If inconsistencies are noted, the field team leader will hold re-training with all teams participating simultaneously. Updates to the SOP and its attached specimen examples will occur as necessary and the EPA Project Team Leader and Technical Assistance Unit will be notified when these updates are recommended by the field team leader or field investigation manager.

Figure 1 – Visible Vermiculite Inspection Process



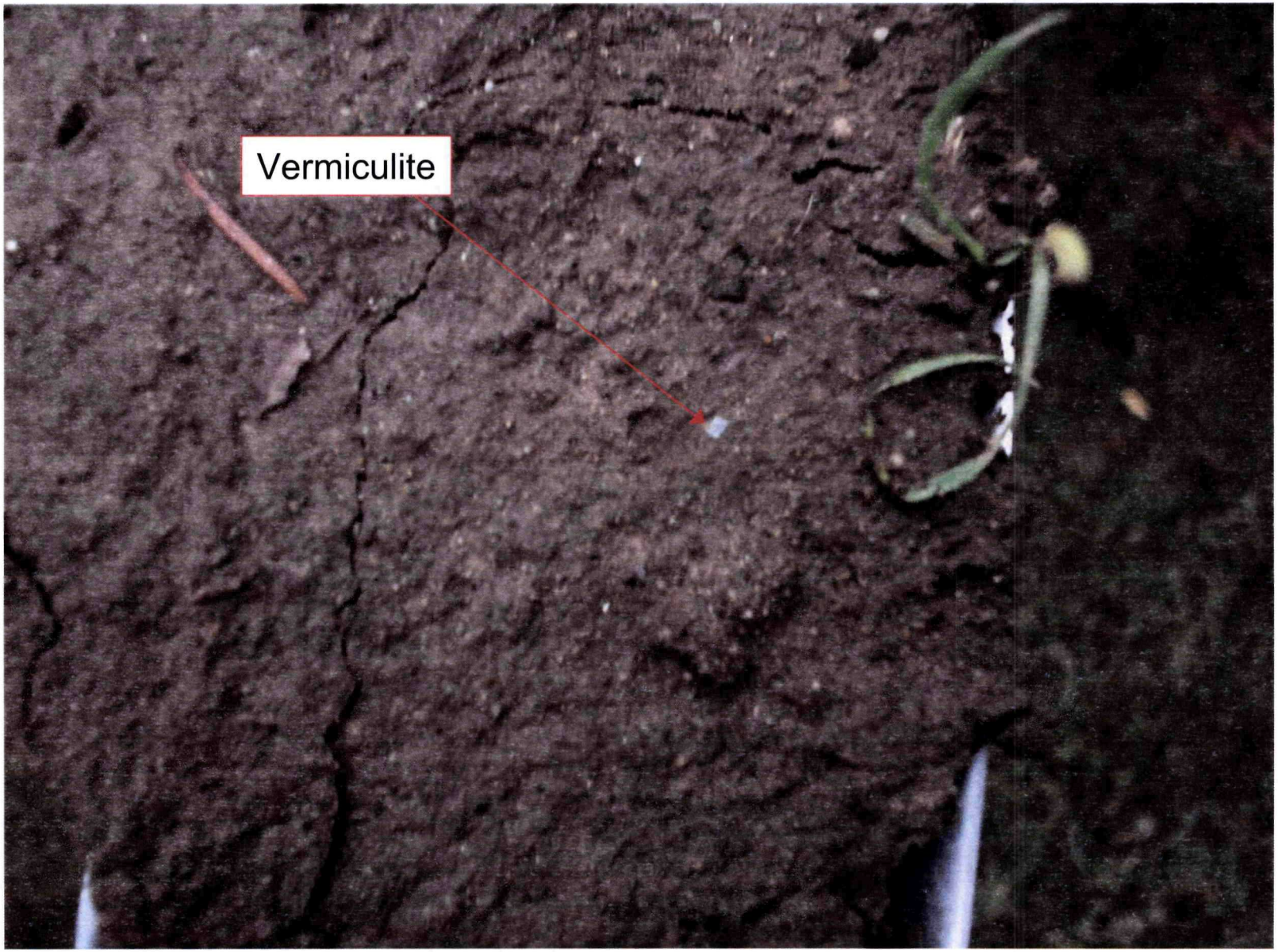


Figure 2a: Low Visible Vermiculite – A maximum of a few flakes of vermiculite observed within a given visual inspection point

Figure 2b: Intermediate Visible Vermiculite – Vermiculite easily observed throughout visual inspection point, including the surface.

Figure 2c: Intermediate Visible Vermiculite – Vermiculite easily observed throughout visual inspection point, including the surface.

Figure 2d: High Visible Vermiculite – Vermiculite easily observed throughout visual inspection point, including the surface.

LIBBY SUPERFUND SITE
Visual Vermiculite Estimation Form (VVEF)

Field Logbook No.: _____ Page No.: _____ Site Visit Date: _____ BD Number: _____

Address: _____ Structure Description: Property

Occupant: _____ Phone No.: _____

Owner (if different than occupant): _____ Phone No.: _____

Investigation Team: _____ Investigation Name: _____

Field Form Check Completed by (100% of Forms): _____ Visual Verification by Field Team Leader (10% of forms): _____

		Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8
Type (SUA/CUA/LUA/IS)									
Description									
Area Size (square feet)									
General Comment (Cover, etc.)									
PIs (X=None, L=Low, M=Intermediate, H=High)	X								
	L								
	M								
	H								
Total		0	0	0	0	0	0	0	0

Areas previously identified for removal not inspected for visible vermiculite? Yes No NA Location(s): _____

Project-Specific Standard Operating Procedure
Libby Asbestos Project

SOP No.: CDM-LIBBY-09, Revision 0
SOP Title: Global Positioning Satellite (GPS) Coordinate Collection and Handling
Project: Libby Asbestos Project
Project No.: 2616
Client: U.S. Department of Transportation (DOT)/Volpe Center

Authored by:

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Date: 5/21/07

Terry Crowell
CDM Quality Assurance Reviewer

1.0 Objective

The objective of this standard operating procedure (SOP) is to provide a standardized approach for the collection and handling of GPS data at the Libby Asbestos Site (Site).

2.0 Background

2.1 Definitions

Libby_Sampling Data Dictionary - All Trimble handheld units used at the Site are pre-programmed with the Libby _Sampling data dictionary, specific to the spatial data collection needs for the Libby Asbestos Project. All personnel required to collect GPS data will be familiar with the contents of the Libby_Sampling data dictionary, which contains the following features: Soil Sample, Air Sample, Dustfall (Settled Dust) Sample, Water/Sediment Sample, Building Location, Interest Point, Sample Area, and Interest Area. The Trimble units also are loaded with a generic data dictionary that handles collection of generic lines, points and areas.

2.2 Discussion

The following attributes are required to be collected as indicated in Table 1 for each feature type when a GPS coordinate is collected:

Table 1 – Attributes Collected in the Libby_Sampling Data Dictionary

Feature Name	Attributes Collected
Building Location	LocationID, Address, Comments
Soil Sample	LocationID, IndexID, Sample_Type, SamplGroup, Upper_Depth, Lower_Depth, Comment
Air and Dustfall Samples	LocationID, IndexID, Sample_ Type, SamplGroup , Comment
Water/Sediment Sample	LocationID, IndexID, Matrix_Type, Comment
Interest Point	Location, Land_Use, Comment
Interest Area	Location, Land_Use, Comment
Sample Area	LocationID, IndexID, Num_of _Composites, Upper_Depth, Lower_Depth, Comment

These attributes are discussed in detail in Section 4 of this document.

3.0 Responsibilities

GPS data is collected by investigation, pre-design, and removal oversight staff as specified in the sampling and analysis plans specific to those programs. Transfer of GPS data from the field

equipment to the onsite server, as well as initial data review, processing, and transmittal of data off-site will be performed by a designated on-site IMS staff member during peak field season (April through November), and by administrative support staff during the off season. These additional procedures are documented separately and are posted on CDM's e-room at: https://team.cdm.com/eRoom/R8-RAC/Libby/0_290a.

4.0 Procedures

The following sections describe how GPS points are collected and handled for features commonly used at the Site.

4.1 GPS Point Collection

Building Locations

For building locations, a GPS point is collected near the front door or main entrance of the building. Location IDs beginning with the prefix "BD" (indicating a building point), are used for such locations.

Soil Samples

For **Grab** samples, a GPS point is collected directly above the location where each sample is collected. Location IDs beginning with the prefix "SP" (indicating a sample point), are used for such locations.

For **Composite** samples, a GPS point is collected at the approximate center of each sample area. In the case of an irregular-shaped sample area or sample area that is non-continuous (e.g., a flowerbed that wraps around a house), a GPS point is collected at the center of the largest continuous sample area. Location IDs beginning with the prefix "SP" are used for such locations.

Outdoor Stationary Air and Dustfall (Settled Dust) Samples

For permanent (i.e., samples represent a consistent monitoring zone or area and are collected on a routine schedule) outdoor stationary air and dustfall sample locations, a GPS point is collected at each unique sample location. All subsequent samples taken at that location will be assigned the same Location ID and X,Y coordinates. The GPS point is only collected once. Location IDs beginning with the prefix "SP" (indicating a sample point), are used for such locations.

GPS points are **not** collected for the following features:

- Stationary air, dust, and soil samples collected inside or beneath structures (locations are associated with the X,Y coordinate of the building where the sample was collected)
- Stationary air samples, with the exception of permanent monitoring locations as designated in site-specific removal work plans or Response Action Work Plan Addenda
- Duplicate or Replicate air or dust samples (assigned the same location ID as the parent sample)
- Soil samples taken at depth from the same X,Y location as a previously collected sample. The at-depth soil sample will be assigned the same Location ID as the shallower sample in order to relate both samples to the same X,Y coordinate.
- Duplicate or split soil samples (assigned the same location ID as the parent sample)
- Personal air samples (locations are associated with the X,Y coordinate of the building or property where the sample was collected)

Interest Point, Interest Area, Sample Area
GPS points for these features are not routinely collected on the Libby Asbestos Project. However, they are included in the Libby_Sampling data dictionary in the event that a GPS point is collected for an area where no sampling is involved, or a series of points is collected to document the perimeter of an interest area or sample area.

4.2 Operation of Trimble Pro XRS and GeoXT Handheld Units:

Operators must be standing at the sample location *before* the unit starts to collect positions. Once the unit has started collecting positions, the operator must remain standing at the sample location until the minimum required positions have been collected. A minimum of 30 positions will be collected for each GPS location. More positions will be required in circumstances where the position dilution of precision (PDOP) is greater than the default setting of 4.5. Plan GPS collection around satellite availability & times when PDOP is < 4.5.

Record-keeping Requirements:

Serial numbers of the Trimble datalogger, receiver, and antenna will be recorded in a field logbook. GPS filenames will be recorded in the logbook and on field sample data sheets (FSDSs).

Data Collection Instructions for Trimble Pro XRS:

Turn on the unit and select *Data Collection* from the main menu. You will be prompted to create a new file, open an existing file, or create a base file. Choose *create new file* and press Enter. There will be a generic default file name that begins with "*RO...*" followed by the date. Create a new file name using the following naming convention: **T1A10204**, where **T1** refers to the specific Trimble unit you are using, **A** refers to the first file of the day (**B** would be the second file of the day, and so on), and **10204** refers to October 20, 2004. You are limited to only 8 characters so the date notation will be MMDDY. The setting for data dictionary should always be set to Libby_Sampling. Press Enter to bring up the Start Feature menu.

From the Start Feature menu you will select the type of location data that you want to collect. Press the F1 key to pause the unit until you are ready to start collecting data. Highlight the appropriate data type and press Enter. (Note, if you do not have the unit paused it will start collecting data as soon as you press Enter.) Using the alphanumeric keypad and the directional keypad enter the *Index* and *Location ID* exactly as they appear on the printed labels. Under the *Sample Type* field you will see an arrow indicating a drop-down menu with preset options. If you scroll to the right while *Sample Type* is highlighted you will see the available options. Select the option you want and then scroll to the right again to exit the drop down menu.

Enter any additional information such as Owner, Sample Grid, Sample Location, etc. in the *Comments* field. Press the F1 key to *resume* collecting positions. The unit will beep for every position it collects displaying the total positions in the lower right corner. After the counter has reached the desired number of positions (30 positions), press Enter and then F1 to confirm and save your data point. Repeat this process for every new location.

Review all entries and correct any mistakes before downloading. You can view and edit the data you have collected by pressing F2 (*Review*) from the Start Feature menu. Use the directional pad to scroll through the locations and press Enter to view the sample information.

If changes are made to the data, be sure to press Enter to save the changes, otherwise just press Esc. Press F2 (*New*) to return to the Start Feature menu.

Additional useful handheld features:

- **Review feature** - allows you to quickly view keyed data for errors, making changes as necessary.
- **Repeat feature** - saves time & reduces keystroke errors when collecting multiple samples of the same type.
- **Offset** - reduces the headache and extra time associated with trying to capture GPS data under bridges, large trees, porches, facades and awnings, or while standing close to a building or other object that can deflect satellites signals from the GPS receiver.
- **Delete Feature** - allows you to delete a feature from a file if, for example, no positions were collected or the sample is voided. This will save time & confusion during the QC process.
- **Rename File** - will allow you to browse through the file names you have created, and quickly edit them if necessary. This will save time if it is done *before* the files are downloaded.
- **Delete File** - will allow you to delete a file from the handheld when necessary. This will save time during the QC process if it is done *before* the files are downloaded.

Data Collection Instructions for Trimble GeoXT:

Turn on the unit and with the stylus, select *GPS* from the lower right menu. This will open the Terra Sync software. Wait for the GPS status screen to recognize at least 4 satellites. Depending on your location, this can take several minutes. If you do not wait long enough, you will you not succeed in collecting your data. The connected satellite names will appear on the left side of the screen - they will be highlighted to indicate that they are connected. Select *Data* from the drop down menus at upper left. There will be a generic default file name that begins with "*RO...*" followed by the date. Create a new file name using the following naming convention: **T1A10204**, where **T1** refers to the specific Trimble unit you are using, **A** refers to the first file of the day (**B** would be the second file of the day, and so on), and **10204** refers to October 20, 2004. You are limited to only 8 characters so the date notation will be MMDDY. The setting for data dictionary should always be set to Libby_Sampling. Select *Create*. Confirm the antennae height by selecting *ok*. Highlight the appropriate feature name and select *Create*. The unit will begin logging the point automatically. Enter the attribute data using the stylus and the keyboard icon located at the bottom of the touch screen. When you are finished recording, hit *ok*, which saves the file and location information. If you have other points to collect within the same file, select the *Options* menu then select *Repeat*.

4.3 GPS Data Transfer

GPS File Transfer to Libbysvr02 from Trimble Pro XRS

- Turn on the Trimble Unit
- *The unit will try to connect to the GPS receiver* - press the **Esc** button
- Select **File Manager**
- Select **File Transfer** - *currently the data consists of .ssf files and is transferred to Libbysvr02\Pfdata\Libby - the file is named with an 8character identifier: T+TrimbleUnitNo+ file number(A for first file collected that day)+mmddy*
- Open Pathfinder Office

- Select **Utilities**
- Select **Data Transfer**
- Select **Add**
- Select **Datafile** – *Pathfinder will search for a connection to the Trimble Unit*
- Connect the cable from the computer to the Trimble Unit
- A list of files will appear when the connection is complete
- Select **Open**
- Select **Transfer All**
- When the download is complete, close the data transfer window – *if downloading files from several units, close and reopen this window between downloads*
- Delete files from the Trimble Unit – *all of the files will be listed - double check that all the files were transferred to libbysvr02 before deleting*

GPS File Transfer to Libbysvr02 from Trimble Pro GeoXT

The Trimble GeoXT connects to a PC through the charger unit using a USB cable *(type A to type B)*, and Microsoft Active Sync software. *(There are Active Sync connection settings to enable or disable once the device is connected to the PC. From the Active Sync menu, select Tools, select Options. These connect the Trimble to other Windows applications on the PC eg; email, task managers, etc. The main reason to disable these settings at Libby, is that the Trimble Units are shared and it does not make sense to activate them.)*

- Turn on the Trimble Unit
- Select **GPS** - from lower right corner *(This opens up the TerraSync GPS software.)*
- Select **Setup**
- Select **Options**
- Select **Disconnect from GPS**
- Select **Data**
- At the bottom of list, select **File Manager**
- Open Pathfinder
- Select **Utilities**
- Select **Data Transfer**
- From the Device list, select **GIS Datalogger on Windows CE**
- Click on the connect icon (the button with the checkmark circled in green). *A picture on the right will indicate the connection status.*

4.4 Preliminary On-site Data Quality Control

Following the download of files from the Trimble units, a copy of each file is made and filed in *Libbysvr02 \ Pfdata \ Libby \ RawFiles*. The raw files are not modified but kept as the only copy of the complete set of original downloaded data files. Using the Pathfinder export utility, shapefiles (.shp) of the non-quality control checked (QC'd) files located in *Libbysvr02 \ Pfdata \ Libby* are exported. These shapefiles are opened in ArcMap. A new export file of the attribute tables from Arcmap is created and saved as a .dbf file, then opened and saved in Excel workbook format. The Excel file is imported as a new table into a recent copy of the Electronic Libby Asbestos Sample Tracking Information Center (eLASTIC). A report is generated linking the index_id of the imported table with the index_id of the eLASTIC sample

table. This report is saved in Excel. An Excel comparison function is used to compare location ids from the GPS files with the eLASTIC Location IDs. Any discrepancies are researched to determine if the error resides on the FSDS, was a data entry error in eLASTIC, or a data entry error in the GPS .ssf file. Errors in the .ssf files are corrected using Pathfinder Office. Files used for this data review process (.shp, .dbf files and .xls files) are not retained. The QC'd .ssf files are then emailed in a .zip file from the Libby Office to off-site GIS staff for processing. The QC'd and .zip files are moved to *Libbysvr02\Pfdata\Libby\QC and sent zip files.*

For reference on using Pathfinder export and ARCMap attribute tables see Eroom: Libby GIS folder: GPS to GIS procedure posted by Mike Schultz on August 29, 2006.

4.5 Equipment, Software & Configuration

For Trimble Pro XRS or Trimble GeoXT:

Software used for data transfer: GPS Pathfinder Office 2.90 and 3.10
TerraSync

Software used for on-site QC: GPS Pathfinder Office 2.90 and 3.10
ArcGIS ArcMap
Microsoft Excel
eLASTIC

Configuration Settings (TSC1 5.27 software)
Software can vary with rental equipment. Some settings can be changed to accommodate data collection needs.

Table - 2 Configuration Settings for Trimble Pro XRS

GPS Rover Options - Logging Options		
Logging Intervals	Point feature	1 s
	Line / area	3 s
	Not in feature	none
	Velocity	none
Confirm end feature	no	
Minimum Positions	30	
Carrier phase	Carrier mode	off
	Minimum time	10mins
GPS Rover Options – Position Filters		
Position mode	Manual 3D	
Elevation mask	15 degrees	
SNR mask	6.0	
DOP type	PDOP	
PDOP mask	6.0	
PDOP switch	4.0	
GPS Rover Options – Real-time input		
Preferred correction source	use uncorrected GPS	
GPS Rover Options – General real-time settings		
Correction age limit	10s	
GPS Rover Options – Antenna options		
Height	6.000USft	

Measure	Vertical	
Confirm	Never	
Type	Integrated GPS/ Beacon/Sat	
Part number	33580-50	
GPS Rover Options – Initial Position		
North	USft	
East	USft	
GPS Rover Options – 2D altitude		
Altitude(MSL)	USft	
Computed at	time	
Computed at	date	
GPS Base Station Options – Logging Options		
Logging Intervals	Measurements	5s
	Positions	30s
Audible Click	Yes	
Log DOP data	Yes	
GPS Base Station Options – Position Filters		
Position mode	Manual 3D	
Elevation mask	15 degrees	
SNR mask	4.0	
PDOP mask	6.0	
PDOP switch	4.0	
GPS Base Station Options – Real-time output options		
Real-time output mode	off	
Radio type	Custom	
Baud rate	9600	
Data bits	8	
Stop bits	1	
Parity	Odd	
RTCM options	Station	1
	Message type	Type 1
	Message interval	5s
	Message suffix	None
	CTS flow control	Off
	CTS xmit delay	0ms
	RTS mode	High
	RTS edge delay	0ms
GPS Base Station Options – Reference position		
Datum	NAD 1983 (Conus)	
Zone	11 North	
NMEA/TSIP Output options		
Output	TSIP	
Baud rate	38400	
Coordinate System	UTM	
Map display options	All show with no background	
Units and Display		
Units	Distance(2D)	US Survey Ft
	Area	Square feet
	Velocity	Miles/Hour
	Angle format	DDMMSSss
	Order	North/East
	North reference	True
	Magnetic declination	Auto

	Null string	
	Language	English
Time and Date	24 hour clock	Yes
	Time	##:##:##
	Date format	MM/DD/YYYY
	Date	MM/DD/YY weekday
Quickmarks	Attributes	Repeat
	Confirm	No
Hardware(TSC1) software version 5.27		

Table - 3 Libby Sampling Data Dictionary
"Libby Sampling", Dictionary
"Soil Sample", point, "", 1, seconds, 1, Code
"LocationID", text, 30, required, "SP-000001", required, SP-
"IndexID", text, 30, required, required, Label1
"Sample_Type", menu, required, required, Label2
"COMPOSITE", default
"GRAB"
"SamplGroup", menu, required, required
"BARN"
"BARROW SOURCE"
"BASEMENT"
"BLANK"
"DRIVEWAY"
"FIELD"
"FLOWER BED"
"GARAGE"
"GARDEN"
"HOUSE"
"PARK"
"PROPERTY"
"ROAD"
"SCHOOL"
"SHED"
"WALKWAY"
"YARD", default
"STOCKPILE"
"Upper_Depth", text, 30, required, "Inches", required
"Lower_Depth", text, 30, required, "Inches", required
"Comment", text, 30, normal, normal
"Air Sample", point, "", 1, seconds, 1, Code
"LocationID", text, 30, required, required
"IndexID", text, 30, required, required, Label1
"Sample_Type", menu, required, required, Label2
"PERSONAL"
"STATIONARY", default
"SamplGroup", menu, required, required
"BARN"
"BARROW SOURCE"
"BASEMENT"
"BLANK"
"DRIVEWAY"
"FIELD"

"FLOWER BED"
"GARAGE"
"GARDEN"
"HOUSE", default
"PARK"
"PROPERTY"
"ROAD"
"SCHOOL"
"SHED"
"WALKWAY"
"YARD"
"Comment", text, 30, normal, normal
"Dustfall Sample", point, "", 1, seconds, 1, Code
"LocationID", text, 30, required, required, Label1
"IndexID", text, 30, required, required, Label2
"Sample_Type", menu, required, required
"BUILDING", default
"VEHICLE"
"NA"
"OTHER"
"SamplGroup", menu, required, required
"BARN"
"BARROW SOURCE"
"BASEMENT"
"BLANK"
"DRIVEWAY"
"FIELD"
"FLOWER BED"
"GARAGE"
"GARDEN"
"HOUSE", default
"PARK"
"PROPERTY"
"ROAD"
"SCHOOL"
"SHED"
"WALKWAY"
"YARD"
"STOCKPILE"
"Comment", text, 30, normal, normal
"Building Location", point, "", 1, seconds, 1, Code
"LocationID", text, 30, required, "BD-000001", required, BD-, Label1
"Address", text, 50, required, normal, Label2
"Comments", text, 30, normal, normal
"Water_Sedmnt Sample", point, "", 1, seconds, 1, Code
"LocationID", text, 30, required, required, Label1
"IndexID", text, 30, required, required, Label2
"Matrix_Type", menu, required, required
"Surface"
"Well", default
"Comment", text, 30, normal, normal

"Interest Point", point, "", 1, seconds, 1, Code
"Location", text, 30, required, required, Label1
"Land_Use", text, 30, required, required, Label2
"Comment", text, 30, normal, normal
"Interest Area", area, "", 3, seconds, Code
"Location", text, 30, required, required, Label1
"Land_Use", text, 30, required, required, Label2
"Comment", text, 30, normal, normal
"Sample Area", area, "For odd composits", 3, seconds, Code
"LocationID", text, 30, required, "SP-000001", required
"IndexID", text, 30, required, required, Label1
"Num_of_Composits", numeric, 0, 0, 100, 5, required, "Number of Composits", required, Label2
"Upper_Depth", text, 30, required, "Inches", required
"Lower_Depth", text, 30, required, "Inches", required
"Comment", text, 30, normal, normal

Site-Specific Sampling Guidance
Libby Superfund Site

Guidance No: CDM-LIBBY-10, Revision 1

Guidance Title: Collection of 30-Point Composite Microvacuum Dust Samples for Determining Nature and Extent of Libby Amphibole Asbestos (LA) in Indoor Dust

Approved by:

Technical Reviewer — Date: 5/10/07

QA Reviewer — Date: 5/10/07

Volpe Center Approval — Date: 05/10/07

EPA Approval — Date: 5/10/07

Section 1
Purpose

The purpose of this standard operating procedure (SOP) is to provide a consistent method for the collection of 30-point composite microvacuum dust samples. This SOP is to be used by contractors/subcontractors supporting EPA investigation activities at the Libby Superfund Site. This SOP describes the processes by which sample locations will be selected and the procedures used to collect samples. Samples collected according to this SOP can be used to determine the nature and extent of LA in indoor dust for assessing clean-up requirements.

Section 2
Responsibilities

Successful execution of this SOP requires a clear hierarchy of assigned roles with different sets of responsibilities associated with each role. All staff with responsibility for the collection of indoor dust samples is responsible for understanding and implementing the requirements contained herein as well as any other governing guidance documents.

Task Leader (TL) or Field Team Leader (FTL) - The TL or FTL is responsible for overseeing sample collection processes as described in EPA-approved governing guidance documents (i.e., site-specific sampling and analysis plans [SAPs], quality assurance project plans [QAPPs], etc.). The TL or FTL is also responsible for checking all work performed and verifying that the work satisfies the specific tasks outlined by this SOP and all governing guidance documents. The TL or FTL will communicate with the field team members regarding the specific collection objectives and anticipated situations that require deviation from this SOP. It is also the responsibility of the TL or FTL to communicate the need for any deviations from the SOP with the appropriate EPA personnel (team leader or their designate), and document the deviations using a Field Modification Form provided in each SAP or QAPP.

Field team members - Field team members performing the sampling described in this SOP are responsible for adhering to the applicable tasks outlined in this procedure while collecting samples at properties associated with the Libby Superfund Site. The field team members should have limited discretion with regard to collection procedures but should exercise judgment regarding the exact location of sample points, within the boundaries outlined by the TL or FTL.

Section 3
Equipment

This section provides a list of equipment required to collect dust samples according to the site-specific protocols detailed in Section 4 and to meet the requirements of American Society for Testing and Materials (ASTM) method D5755-03 (ASTM 2003).

- Sampling pump - The sample pump used in the collection of microvacuum dust samples will be capable of flow rates typically used for dust sampling, 2.0 liters per minute (L/min). The pump must be capable of providing a non-fluctuating air-flow through the sampling media, and maintain the initial flow-rate volume to within ±10 percent (%) throughout the sampling period.

- Rotameter - A rotameter will be used as a secondary calibration standard as required for verifying the flow rate of the sampling pump used for sample collection. The rotameter will be calibrated such that the operator can measure flow rates to ±5% accuracy at the expected flow rate. Each rotameter in use should be calibrated against a primary standard as required according to manufacture recommendations and governing guidance documents.

- Sample cassettes - The sample cassettes used for the collection of microvacuum dust samples at the Libby Superfund Site are a commercially available 25-millimeter (mm), three-piece cassette with a 50-mm electronically conductive extension cowl loaded with a 0.45 micrometer (µm) mixed cellulose ester (MCE) filter. The sampling nozzle attached to the cassette inlet will meet the following specifications as described in ASTM D5755-03 (ASTM 2003): the sampling end will be cut at a 45° angle, and the length of tubing will be at least 25 to 37 mm in length and 0.25 inches in diameter.

- Inert tubing - Tygon® tubing with a 3/16-inch inner diameter and 5/16-inch outer diameter is used in the sample collection train to connect the outflow end of the sample cassette to the sampling pump.

- Sample ID labels (Index IDs) - pre-printed index ID number labels are placed on the sampling cassette to indicate the unique sampling number assigned to the sample. Index ID labels can also be used in logbooks/PDAs and on other field forms for sample identification. The specific index ID numbers used will be detailed in governing guidance documents.

- Collection area templates - 10 by 10 centimeter (cm) reusable plastic or disposable cardstock (paper) templates are used to delineate each sample point. When a plastic template is used, it will be wiped with a disposable wet towel between each individual sample (i.e., not between individual aliquots). When a paper template is used, a new template will be used after each sample.

- Zip-top plastic bag - after sample collection is complete, each sample cassette will be placed in an individual zip-top plastic bag. The index ID label will be placed on the outside of the zip-top bag and affixed with clear tape if necessary. The index ID may also be written on the outside of the bag using a permanent marker (preferred). Sample cassettes are placed into individual bag to mitigate the potential for cross-contamination in the event that a cassette should open during handling or shipping.

- Field logbook or PDA -used to record progress of the sampling effort and record any problems and field observations.
- Cooler or other ridged container - used to store samples while in the field.
- Custody Seals - aid in ensuring the integrity of samples during handling or shipping.
- Latex or Nitrile Gloves – Worn during dust sample collection to prevent cross-contamination.

Section 4
Selection of Sample Locations

Governing guidance documents should be consulted to determine when microvacuum dust sampling is required.

When sampling is required, one 30-point composite sample will be collected on a single sampling cassette per living floor, or as required for secondary buildings. Each dust sample will be collected from areas classified on a scale of accessibility as described below:

1. Accessible areas refer to locations where exposures are most likely to occur – places where dust accumulates and is encountered daily. This includes soft surfaces such as carpet (not including movable floor mats), upholstered furniture, floors, and waist-high hard surfaces such as counter tops and non-carpeted floors.

2. Infrequently accessed areas refer to locations where dust may accumulate, but exposures are likely to occur infrequently. This includes areas on tops of shelves, entertainment centers, and refrigerators, etc.

3. Inaccessible areas refer to locations where dust may accumulate but exposures occur only rarely, such as behind refrigerators or other large infrequently moved objects.

To the extent possible, the sample point locations will be collected from each type of accessibility area as indicated below:

1. **Accessible** target areas, if present (as indicated, some locations described should only be included when visible dust can be observed with the unaided eye of the field team members):
    a. Flooring (soft or hard surface) at the main entrance used by occupants
    b. Flooring at the secondary or less heavily used entrance to the home
    c. Flooring in the center of the living room or family room
    d. Flooring in the center of bedrooms

e. Flooring in an acknowledged or evident route of high traffic (i.e., hallway or other thoroughfare)
f. Flooring in the kitchen
g. Kitchen counter tops, ***only when visible dust is observed***
h. Table tops in the following rooms: dining room, living room, or family room, ***only when visible dust is observed***
i. Table tops (e.g., night stands, bureaus) in bedrooms, ***only when visible dust is observed***
j. Window sills in the dining room, living room, or family room
k. Window sills in the bedrooms
l. Upholstered furniture in the living room

2. **Infrequent** target areas, if present:
   a. Top of the refrigerator, when top is exposed
   b. Top of bookshelves
   c. Shelves of bookshelves
   d. Top of the hot water heater
   e. Top of wood stoves
   f. Fireplace mantels and/or hearths
   g. Beneath the sofa or other large pieces of furniture in the living room
   h. Beneath the bed or other large pieces of furniture in bedrooms
   i. Inside kitchen cabinets most frequently accessed

3. **Inaccessible** target areas, if present:
   a. Beneath infrequently moved heavy appliances when accessible without moving the appliance (e.g., refrigerator, washing machine, dryers, dishwashers, etc.)
   b. Inside forced air floor or ceiling vents in the living room
   c. Inside forced air floor or ceiling vents in the bedrooms
   d. Inside forced air floor or ceiling vents in the kitchen or bathroom
   e. Corners of closets or other similar small areas not frequently accessed or cleaned

The preferred distribution of the 30-sample points among the three target areas described above is as follows:

- 12-sample points collected from **Accessible** target areas
- 12-sample points collected from **Infrequent** target areas
- 6-sample points collected from **Inaccessible** target areas

Sampling Contingencies

The preferred sample distribution may not always be achievable given the varying conditions of buildings at the Libby Superfund Site. This section discusses situations

when the preferred distribution may not be achieved and provides guidance to the field team members for determining how sample points should be distributed.

1. When the preferred distribution cannot be achieved due the lack of locations in a specific target area category, the remaining number of sampling locations required to reach a total of 30-sample points should be distributed among other target areas according to the preferred distribution ratio (2:2:1).

   For example: If 12 **Accessible** and 12 **Infrequent** target areas are identified and sampled, and only 2 **Inaccessible** target areas are identified and sampled; 4 points remain to be sampled so the total number of sample points adds to 30. The four remaining locations should be distributed evenly among **Accessible** and **Infrequent** target areas, with 2 sample locations collected from each area type.

   If the preferred distribution cannot be achieved, the number of sub-sampling points collected for the composite sample will be recorded as specificed by project specific guidance.

   When unfurnished areas, primary buildings, or secondary building require dust sampling, the locations selected for **Accessible** and **Infrequent** target areas should include flooring and all available horizontal surfaces. It may be necessary to collect several sample points from flooring within the same room in order to meet the overall goal of collecting 30points. The potential issues discussed in Sampling Contingency #1 also apply to this situation.

2. In some cases secondary buildings may be so small that 30 discrete sample points do not exist in the building. This is most likely to occur when dust sampling in a pump house or other similarly sized structure. When this situation is encountered, the field team member will record the number of locations that were obtained and document this deviation according the governing guidance document. The potential issues discussed in Sampling Contingency #1 also apply to this situation.

Section 5
Sample Procedures

Once sampling cassettes have been deemed usable via submittal of lot blanks to the analytical laboratory (see Section 8.2), each sample will be collected, after calibration of the sampling pump and identification of individual increments (sub-samples), according to the following procedures modified from ASTM D5755-03 (ASTM 2003):

1. Set-up the sampling train by attaching the sampling cassette to the sampling pump at the outlet side of the cassette with the required tubing. The length of tubing between the sampling cassette and the sampling pump should be long enough to allow sampling locations to be reached without interfering with the

operation of the sampling pump. If a pre-assembled cassette is used, remove the end cap. If a an inlet nozzle must be assembled:

a. Attach an unused portion of tubing, approximately 25.4 mm in length with an internal diameter of 6.35 mm, directly to the inlet orifice.

b. Cut the sampling end of the tubing at a 45° angle leaving a length of tubing between 25 mm and 37 mm between the inlet orifice and the cut end of the tubing.

2. Don latex or nitrile gloves.

3. Place a sampling template on the area to be sampled. Turn the sampling pump on and begin timing using a stopwatch. Each template (sub-sample location) should be sampled for approximately 30 seconds at a flow rate of 2.0 L/min. The field team member should strive to make three orthogonal collection passes per template during the 30second interval. During the collection period, the surface being sampled should not be scraped or abraded with the collection nozzle.

4. When the 30-second collection period has been completed, invert the sampling cassette so the collection nozzle is pointed upwards. Turn the sampling pump off and stop the stopwatch (do not clear the time from the watch).

5. Repeat sample collection as described in Steps 2 and 3 for the remaining sampling points collecting a cumulative time of collection (approximately 15 minutes) on the stopwatch.

6. During the dust sampling pilot, verify the flow rate after every 5th sampling location (5th, 10th, 15th, 20th, 25th, and 30th) according to the following:

a. Turn the sampling pump off.

b. Connect the rotameter in a calibration train. Ensure the rotameter is within 6° of vertical.

c. Turn the sampling pump on.

d. Record the observed flow rates on the rotameter according to governing guidance document.

e. If required, adjust the flow rate back to 2.0 L/min according to instructions provided for the specific the sampling pump in use.

f. Turn the sampling pump off.

g. Record the value of the ending flow rate according to the governing guidance documents.

The verification frequency may be reduced after experienced is gained during the collection activities.

After the pilot phase, verify the flow rate at the beginning and at the end of each sampling event for each floor.

7. After the last location has been sampled and the final flow rate recorded as described in Step 5, turn the sampling pump off and seal each end of the cassette with a cassette end-plug. This can be done with either the sampling nozzle left in place (preferred) or removed. If the nozzle is removed it should also be sealed at both ends with an end-plug and placed in a separate zip-top bag for shipment to the laboratory. The nozzle is always saved and rinsed at the laboratory during sample preparation because a significant percentage of the dust drawn from a lightly loaded surface may adhere to the inside walls of the tubing.

8. Record the total elapsed sample collection time and total area sampled and other information as required according to governing guidance documents.

9. Wipe off the exterior surface of the cassette with disposable wet towel.

10. Place a sample label (index ID) on the cassette that clearly identifies the sample's unique identification number on the cassette.

11. Place a sample custody seal around both ends of the sampling cassette in a manner that does not obstruct the sample label.

12. Place each sample cassette in an individual plastic zip-top bag. Each bag should be labeled indicating the sample index ID. Do not put the sample cassette in a shirt or coat pocket as the filter can pick up fibers from clothing.

13. Decontaminate sampling equipment as required by the governing guidance document.

14. Transport the samples in a ridged container to the sample coordinator or designated recipient.

Dust field duplicate samples will be collected at the frequency required in the governing guidance documents. Field duplicate samples will be collected immediately adjacent to the locations of the parent sample. The duplicate will be collected from the same number of sub-samples as the parent sample, and be distributed across assess areas identically to the parent sample. For tracking purposes, the parent/duplicate sample relationship will be recorded in accordance with sample documentation requirements stated in the governing guidance document.

Section 6
Sample Custody and Shipment

Dust samples will be kept separate from other types of media sampled (i.e., soil, air, water, building materials, insulation, etc.) and should be transported in a ridged container until the field team can relinquish custody to the sample coordinator or designated recipient.

When dust samples are be shipped to on off-site analytical laboratory, a ridged sealed container will be used. Dust samples will be shipped separated from any other types of media. The cassettes must be tightly sealed and packaged in a material free of fibers or dust to minimize the potential for contamination. Plastic bubble wrap is an example of the appropriate material for this purpose. Examples of inappropriate materials are paper and packing peanuts.

Section 7
Documentation

As required by governing guidance documents, a field logbook/PDA will be maintained by each individual or team that is collecting samples as described in this SOP. The guidance documents will detail specific conditions which require attention and documentation, but at a minimum the following information should be collected:

- Project name
- Title of governing documents
- Property address
- Date
- Time
- Team members
- Weather conditions
- Locations of any samples or sub-samples that could not be acquired
- Descriptions of any deviations to the SOP or SAP and the reason for the deviation
- Relinquishment of samples to project sample coordinator or other recipient

In addition to logbook/PDA documentation, specifics regarding details of the sample collection will be recorded as required by governing guidance documents.

Section 8
Quality Assurance/Quality Control
8.1 Equipment Maintenance

The manufacturer's instructions regarding operating procedures and maintenance will be reviewed prior to equipment use. Equipment and instrumentation will be utilized in accordance with manufacturer's instructions.

8.2 Collection of Field Quality Control Samples

Field quality control (QC) samples will consist of three types: lot blanks, field blanks, and field duplicates. The Site-Wide QAPP (CDM 2007) describes each of these samples, their corresponding acceptance criteria, and potential actions if acceptance criteria are not met. Governing guidance documents should be consulted to determine the required collection frequency for each sample type.

Section 9
Glossary

Governing guidance documents - The written document that spells out the detailed site-specific procedures to be followed by the project leader and the field personnel for completing specific investigations. These documents will clearly indicate specific requirements for the implementation of this SOP.

Sample Point - The actual location at which the dust sample is taken. The dimension of a sample point is 100 cm^2.

Composite Sampling - A sample program in which multiple sample points are compiled together and submitted for analysis as a single sample.

Libby Superfund Site - The Libby Superfund Site contains all buildings and land within the boundaries of each operable unit (OU) of the site and illustrated on the most recent version of the OU boundary map.

Section 10
References

ASTM. 2003. Standard Test Method for Microvacuum Sampling and Indirect Analysis of Dust by Transmission Electron Microscopy for Asbestos Structure Number Surface Loading. ASTM D5755-03.

CDM. 2007. Site-Wide Quality Assurance Project Plan. Draft in review.

APPENDIX C

INDOOR ACTIVITY BASED SAMPLING (ABS) SCRIPT

Indoor Activity Based Sampling (ABS) Script

The following provides guidance for actor's performing indoor activity based sampling as described in the current version of the Sampling and Analysis Plan (SAP) for Indoor Air, Operable Unit (OU 4) for the Libby, Montana Superfund Site.

Pre-Activity Sampling

Prior to beginning sample collection, each residential structure will be assessed to determine the number of rooms on each living floor of the main structure where sampling will be conducted. The total sampling time for each period (passive and active) will be divided evenly among the total number of rooms in which routine living activities occur. Areas such as bathrooms and closets will not be included.

For example, if the home is comprised of one floor that contains 6 rooms (living room, 1 study, 1 kitchen, and 3 bedroom) the total time of the passive sampling period (4 hours) would be divided evenly among the 6 rooms (240 minutes / 6 rooms = 40 minutes per room).

In another example, the home described above could contain two floors where the second floor is an unfinished basement that is not part of the resident's functional living space. In this case, the time per room would remain the same (unfinished basement would not be included).

Passive Period Sampling

Activities conducted in the passive sampling period will be mostly sedentary with little movement. Movement will be restricted to walking between rooms and sitting on upholstered chairs and/or cushions. While seated the actor may read, watch television, play video games or complete required paperwork.

The actor should transition to each room when required, walk around the perimeter of the room once upon initial entry and then remain seated for the duration of the time required in the room.

Given the example home described above, the following is an example of how the passive period sampling would be executed:

Passive Period Execution Example			
Location	**Minutes Elapsed Since Start**	**Activity**	**Total Time of Activity in Location (minutes)**
Room 1	0 to 0.5	Walk around perimeter of room 1	0.5
	0.5 to 40.5	Seated in room 1	40
Room 2	40.5 to 41.0	Transition to room 2 and walk around perimeter	0.5
	41.0 to 81.0	Seated in room 2	40
Room 3	81.0 to 81.5	Transition to room 3 and walk around perimeter	0.5
	81.5 to 101.5	Seated in room 3	40
Room 4	101.5 to 102.0	Transition to room 4 and walk around perimeter	0.5
	102.0 to 142.0	Seated in room 4	40
Room 5	142.0 to 142.5	Transition to room 5 and walk around perimeter	0.5
	142.5 to 182.5	Seated in room 5	40
Room 6	182.5 to 222.5	Transition to room 6 and walk around perimeter	0.5
	222.5 to 242.5	Seated in room 6	40

Active Period Sampling

Activities conducted in the active sampling period will involve various levels of dust generating activities. These activities will include walking, sitting on upholstered chairs and/or cushions, sweeping non-carpeted floors, and vacuuming carpeted floors. Brooms used for the activity will be supplied by the contractor and to the extent possible, reused at the same property during follow-on sampling. Vacuums to be used will be non-HEPA and when possible will be the vacuum used by the owner of the property. If a non-HEPA vacuum is not available, vacuuming will not occur.

When carpeted and non-carpeted flooring is present in the same room, sweeping or vacuuming will be conducted only on the flooring type that covers the majority of the surface area.

These activities should be conducted for equal periods of time in each room. For example, if the time required per room is 40 minutes, each of the three activities should be conducted for approximately 13 minutes.

Given the example home described above, the following is an example of how the passive period sampling would be executed (assuming no upholstered furniture is present in rooms 2 or 5):

Active Period Execution Example			
Location	**Minutes Elapsed Since Start**	**Activity**	**Total Time of Activity in Location (minutes)**
Room 1	0 to 13.0	Walk on flooring in room 1	13
	13.0 to 26.0	Sit on upholstered furniture in room 1	13
	26.0 to 39.0	Sweep non-carpeted flooring in room 1	13
Room 2	39.0 to 39.5	Transition to room 2	0.5
	39.5 to 59.5	Walk on flooring in room 2	20
	59.5 to 79.5	Vacuum carpeted flooring in room 2	20
Room 3	79.5 to 80.0	Transition to room 3	0.5
	80.0 to 93.0	Walk on flooring in room 3	13
	93.0 to 106.0	Sit on upholstered furniture in room 3	13
	106.0 to 119.0	Sweep non-carpeted flooring in room 3	13
Room 4	119.0 to 119.5	Transition to room 4	0.5
	119.5 to 132.5	Walk on flooring in room 4	13
	132.5 to 145.5	Sit on upholstered furniture in room 4	13
	145.5 to 158.5	Vacuum carpeted flooring in room 4	13
Room 5	158.5 to 159.0	Transition to room 5	0.5
	159.0 to 179.0	Walk on flooring in room 5	20
	179.0 to 199.0	Vacuum carpeted flooring in room 5	20
Room 6	199.0 to 199.5	Transition to room 6	0.5
	199.5 to 212.5	Walk on flooring in room 6	13
	212.5 to 225.5	Sit on upholstered furniture in room 6	13
	225.5 to 238.5	Sweep carpeted flooring in room 6	13

APPENDIX D
FIELD SAMPLE DATA SHEETS

Sheet No.: D- 00«seq»

LIBBY FIELD SAMPLE DATA SHEET (FSDS) FOR ABS DUST

Field Logbook No: _____ Page No: _____ Sampling Date: _____

Address: _____ Owner/Tenant: _____

Business Name: _____

Land Use: Residential School Commercial Mining Roadway Other ( )

Sampling Team: CDM Other _____ Names: _____

Data Item	Parameter Details
Index ID	
Location ID	
Sample Group (circle) (Subgroup of the property)	House Other_____
Location Description (circle) (Detailed description point within the location)	Basement, Ground Floor, Second Level Other_____
Matrix Type (circle)	Accessible Areas Infrequently Accessed Areas Inaccessible Areas Other_____
Category (circle)	FS FB FD of _____ LB
Sample Area (cm^2) (circle)	1,000 NA Other_____
Filter Diameter (circle)	25mm 37mm
Pore Size (circle)	TEM- 0.45 PCM- 0.8
Flow Meter Type (circle)	Rotameter Dry-Cal NA
Pump ID No.	
Flow Meter ID No.	
Start Time	
Start Flow (L/min)	
Stop Time	
Stop Flow (L/min)	
Pump Fault? (circle)	No Yes
Total Time (minutes)	
Total Flow (liters)	
Field Comments	
Cassette Lot Number: _____	Archive Blank (circle): Yes No
Entered (LFO) _____	Volpe: Entered ____ Validated ___

Location Details (circle all that apply)

Accessible – (Target 4 points)

POROUS SURFACES

1. Carpeted flooring, secondary entrance: (# of points): ____
2. Carpeted flooring, living room: (# of points): ____
3. Carpeted flooring, bedroom(s): (# of points): ____
4. Carpeted flooring, high traffic route: (# of points): ____
5. Carpeted flooring, kitchen: (# of points): ____
6. Upholstered furniture: (# of points): ____
7. Drapes or curtains: (# of points): ____
8. Other:_____: (# of points): ____

NON-POROUS SURFACES

1. Un-carpeted flooring, main entrance: (# of points): ____
2. Un-carpeted flooring, secondary entrance: (# of points): ____
3. Un-carpeted flooring, dining room: (# of points): ____
4. Un-carpeted flooring, living room: (# of points): ____
5. Un-carpeted flooring, bedroom(s): (# of points): ____
6. Un-carpeted flooring, high traffic route: (# of points): ____
7. Un-carpeted flooring, kitchen: (# of points): ____
8. Kitchen counter tops: (# of points): ____
9. Table top(s), living room: (# of points): ____
10. Table top(s), dining room: (# of points): ____
11. Table top(s), bedrooms (# of points): ____
12. Window sill(s) in living room (# of points): ____
13. Window sill(s) in dining room (# of points): ____
14. Window sill(s) in bedrooms (# of points): ____

Infrequently Accessed (Target 4 points)

1. Top of refrigerator (# of points): ____
2. Top of bookshelves (# of points): ____
3. Shelves of bookshelf (# of points): ____
4. Top of hot water heater (# of points): ____
5. Beneath furniture in living room (# of points): ____
6. Beneath furniture in bedrooms (# of points): ____
7. Inside kitchen cabinets (# of points): ____

Inaccessible Areas (Target 2 points)

1. Beneath heavy appliances (# of points): ____
2. Forced air vents in main living room (# of points): ____
3. Forced air vents in bedrooms (# of points): ____
4. Corner of small areas (# of points): ____

Field Team Completion (Initials)	Completed by	QC by

vs 051507

Sheet No.: S- 00«seq»

LIBBY FIELD SAMPLE DATA SHEET (FSDS) FOR SOIL

Field Logbook No: _____ Page No: _____ Sampling Date: _____

Address: _____ Owner/Tenant: _____

Business Name: _____

Land Use: Residential School Commercial Mining Roadway Other ( )

Sampling Team: CDM Other _____ Names: _____

Data Item	Sample 1	Sample 2	Sample 3
Index ID			
Location ID			
Sample Group			
Location Description (circle)	Back yard Front yard Side yard Driveway Other _____	Back yard Front yard Side yard Driveway Other _____	Back yard Front yard Side yard Driveway Other _____
Category (circle)	FS FD of _____ EB LB	FS FD of _____ EB LB	FS FD of _____ EB LB
Matrix Type (Surface soil unless other wise noted)	Surface Soil Other _____	Surface Soil Other _____	Surface Soil Other _____
Type (circle)	Grab Comp. # subsamples _____	Grab Comp. # subsamples _____	Grab Comp. # subsamples _____
GPS Status (circle)	Collected Previously Collected Not Collected-no signal (3 attempts) Not Collected-not required for sample	Collected Previously Collected Not Collected-no signal (3 attempts) Not Collected-not required for sample	Collected Previously Collected Not Collected-no signal (3 attempts) Not Collected-not required for sample
GPS File (fill in or circle)	Filename:_____ NA	Filename:_____ NA	Filename:_____ NA
Sample Time			
Top Depth (inches below ground surface)			
Bottom Depth (inches below ground surface)			
Field Comments *Note if vermiculite is visible in sampled area*	BD-_____	BD-_____	BD-_____
Entered (LFO) _____	Volpe: Entered _____ Validated _____	Volpe: Entered _____ Validated _____	Volpe: Entered _____ Validated _____

For Field Team Completion (Provide Initials)	Completed by:	QC by:

vs 10507

Sheet No.: PA- 00«seq»

LIBBY FIELD SAMPLE DATA SHEET (FSDS) FOR PERSONAL AIR

Field Logbook No: _____ Page No: _____ Sampling Date: _____

Address: _____ Owner/Tenant: _____

Business Name: _____

Land Use: Residential School Commercial Mining Roadway Other ( )

Sampling Team: CDM Other _____ Names: _____

Person Sampled: _____ SSN: _____ Task: _____

Data Item	Cassette 1	Cassette 2	Cassette 3
Index ID			
Location ID			
Sample Group			
Location Description			
Category (circle)	FS FB-(field blank) LB-(lot blank)	FS FB-(field blank) LB-(lot blank)	FS FB-(field blank) LB-(lot blank)
Matrix Type (circle)	Indoor Outdoor	Indoor Outdoor	Indoor Outdoor
Filter Diameter (circle)	25mm 37mm	25mm 37mm	25mm 37mm
Pore Size (circle)	TEM- .45 PCM- 0.8	TEM- .45 PCM- 0.8	TEM- .45 PCM- 0.8
Flow Meter Type (circle)	Rotometer DryCal NA	Rotometer DryCal NA	Rotometer DryCal NA
Pump ID Number			
Flow Meter ID No.			
Start Date			
Start Time			
Start Flow (L/min)			
Stop Date			
Stop Time			
Stop Flow (L/min)			
Pump fault? (circle)	No Yes NA	No Yes NA	No Yes NA
MET Station onsite?	No Yes NA	No Yes NA	No Yes NA
Sample Type	TWA EXC NA	TWA EXC NA	TWA EXC NA
Field Comments Cassette Lot Number: _____	Archive Blank (circle): Yes No	Archive Blank (circle): Yes No	Archive Blank (circle): Yes No
Entered (LFO) _____	Volpe: Entered _____ Validated _____	Volpe: Entered _____ Validated _____	Volpe: Entered _____ Validated _____

For Field Team Completion (Provide Initials)	Completed by	QC by

vs 10507

APPENDIX E
LIBBY ASBESTOS PROJECT RECORD OF MODIFICATION FORM

Record of Modification

to the

Libby Sampling and Quality Assurance Project Plan

Field Activities

LFO-0000__

Instructions to Requester: **Fax to contacts at bottom of form for review and approval.**
File approved copy with Data Manager at the Libby Field Office (LFO).
Data Manager will maintain legible copies in a binder that can be accessed by LFO personnel.

Project QAPP (circle one): Phase I (approved 4/00) Phase II (approved 2/01)
Removal Action (approved 7/00) Contaminant Screening Study (approved 5/02)
Other (Title and approval date):_____

SOP (Number and Revision No.):_____
_____

Other Document (Title, Number/Revision): _____

Requester: _____ Title: _____
Company: _____ Date: _____

Description of Modification (attach additional sheets if necessary; state section and page numbers of SQAPP that are affected by the proposed modification):_____
_____
_____

Field logbook and page number where Modification is documented (or attach associated correspondence):
_____

Potential Implications of Modification: _____
_____
_____

Duration of Modification (circle one):
Temporary Date(s):_____
Resident address(es): _____
_____
- If appropriate, attach a list of all applicable Index Identification numbers.

Permanent (Proposed Text Modification Section) Effective Date:_____

Proposed Text Modifications in Associated Guidance Document (attach additional sheets if necessary):____
_____
_____

Data Quality Indicator (circle one) – Please reference definitions on reverse side for direction on selecting data quality indicators:

Not Applicable **Reject** **Low Bias** **Estimate** **High Bias** **No Bias**

Technical Review and Approval: _____ Date:_____
(Volpe Project Manager or designate)

EPA Review and Approval: _____ Date:_____
(USEPA RPM or designate)

DATA QUALITY INDICATOR DEFINITIONS

Reject - Samples associated with this modification form are not useable. The conditions outlined in the modification form adversely effect the associated sample to such a degree that the data are not reliable.

Low Bias - Samples associated with this modification form are useable, but results are likely to be biased low. The conditions outlined in the modification form suggest that associated sample data are reliable, but estimated low.

Estimate - Samples associated with this modification form are useable, but results should be considered approximations. The conditions outlined in the modification form suggest that associated sample data are reliable, but estimates.

High Bias - Samples associated with this modification form are useable, but results are likely to be biased high. The conditions outlined in the modification form suggest that associated sample data are reliable, but estimated high.

No Bias - Samples associated with this modification form are useable as reported. The conditions outlined in the modification form suggest that associated sample data are reliable as reported.